

May 25-26, 2016 Ozone Exceptional Event Analysis

Technical Support Document

Connecticut Department of Energy and Environmental Protection

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Table of Contents

1. Overview	1
1.1 Introduction	1
1.2 EPA Exceptional Event Guidance.....	3
1.3 Connecticut’s Exceptional Event Request	5
2. Conceptual Model of Event	6
2.1 Monitoring Network.....	6
2.2 Monitored Data	10
2.3 Connecticut Ozone Monitors	11
2.4 Monitored Concentrations.....	12
2.5 Meteorological Scenarios	16
2.8 Meteorological Conditions.....	17
3. Clear Causal Weight of Evidence	21
3.1 Satellite Photos, Webcams and Plume Analysis	21
3.2 Percentile Rankings.....	28
3.3 Similar Day Analysis	41
3.4 HYSPLIT Trajectory Analysis.....	47
3.5 CSAPR NOx Source Emissions.....	52
3.6 NOAA CMAQ Model Predictions.....	54
3.5 Causal Evidence Conclusion.....	58
4. Caused by a natural event	59
4.1 Definition of a Wildfire.....	59
4.2 Conclusion.....	59
5. Not Reasonably Controllable or Preventable.....	59
5.1 Exceptional Event Provisions.....	59
5.2 Conclusion.....	59
6. Public Comment (to be completed later)	60
6.1 Exceptional Events Rule Provisions	60
6.2 Supporting Documentation	60
6.3 Conclusion Statement.....	60

Figure 1. Air Quality Index (AQI) Maps for May 24-25th showing the transport of ozone southeast from the Great Lakes.....	2
Figure 2. Wildfires approaching Fort McMurray, Alberta around May 3, 2016.....	2
Figure 3. Hectares Burned reported by the Alberta Canada Government.	5
Figure 4. CTDEEP Air Monitoring Network Site Map.....	7
Figure 5. Map of Connecticut's Ozone Monitoring Sites.	10
Figure 6. Preliminary 2016 8-hour Ozone Design Values for Connecticut.....	12
Figure 7. Hourly Ozone Concentrations for May 24-29, 2016.....	14
Figure 8. Hourly PM2.5 Concentrations in Connecticut for May 22-28, 2016.....	14
Figure 9. Monitored Black Carbon (BC), DeltaC PM2.5, Carbon Monoxide (CO) and Ozone at the Cornwall CT Monitor.....	15
Figure 10. Aerosol Backscatter Intensity over New Haven with PM2.5 Levels	15
Figure 11. Number of Ozone Exceedance Days in Connecticut Ozone Monitors Since 1997	16
Figure 12. State-wide Ozone Exceedance Scenario	18
Figure 13. Surface Fronts May 23-26, 2016.....	19
Figure 14. 850mb Heights, Temperatures and Wind Flow for May 23-26, 2016	20
Figure 15. MODIS Satellite Photos Showing Visible Plume over Northern Great Lakes, May 18-19, 2016.....	21
Figure 16. VIIRS Satellite Images for May 25-26, 2016, showing the Analyzed Aerosol Optical Depth (AOD) Associated with the Smoke Plume.....	23
Figure 17. HMS Smoke Analysis from May 21-26th, 2016.....	24
Figure 18. Cornwall Connecticut Webcam May 24-26, 2016.....	25
Figure 19. Talcott Mountain Connecticut Webcam May 24-26, 2016.....	26
Figure 20. OMI Satellite Carbon Monoxide Plume May 17-24, 2016	27
Figure 21. May 20, 2016 VIIRS Satellite Images: Visible on left; AOD on right	28
Figure 22. Ranked 8-hour Ozone Distribution for Abington CT 2012-2016	29
Figure 23. Ranked 8-hour Ozone Distribution for Cornwall CT 2012-2016	30
Figure 24. Ranked 8-hour Ozone Distribution for E Hartford CT 2012-2016.....	30
Figure 25. Ranked 8-hour Ozone Distribution for Westport CT 2012-2016.....	31
Figure 26. Cornwall CT Daily Ozone Season Maximums 2012-2016.....	32
Figure 27. East Hartford CT Daily Ozone Season Maximums 2012-2016.....	33
Figure 28. Abington CT Daily Ozone Season Maximums 2012-2016.....	34
Figure 29. Westport CT Daily Ozone Season Maximums 2012-2016	35
Figure 30. Monitored Daily Maximum 8-hour Ozone for 2011-2016 at Connecticut Hill, NY ..	36
Figure 31. CSN Sites Selected for Speciation Analysis	37
Figure 32. Buffalo New York CSN Data.....	38
Figure 33. Rochester New York CSN Data	38
Figure 34. Dearborn Michigan CSN Data	39
Figure 35. Grand Rapids Michigan CSN Data	39
Figure 36. Seney Michigan IMPROVE Data	40
Figure 37. Allen Park Michigan CSN Data	40
Figure 38. Tecumseh Michigan CSN Data.....	41
Figure 39. Temperatures and Winds around Connecticut on July 6, 2010.....	42
Figure 40. 12z ALY Sounding from May 25 th , 2016.....	43

Figure 41. 850 mb Reference Pressure Pattern for May 25th, 2016.....	44
Figure 42. HYSPLIT Reference Trajectories from May 25th, 2016	45
Figure 43. Matching 850 mb Pressure Pattern with Back Trajectories June 18, 2014	46
Figure 44. Matching 850 mb Pressure Pattern with Back Trajectories July 15, 2013.....	46
Figure 45. Matching 850 mb Pressure Pattern with Back Trajectories July 16, 2012.....	46
Figure 46. Matching 850 mb Pressure Pattern with Back Trajectories May 13, 2015	47
Figure 47. Matching 850 mb Pressure Pattern with Back Trajectories July 3, 2016.....	47
Figure 48. 120-hour HYSPLIT Forward Trajectories from Fort McMurray May 18-23, 2016...	48
Figure 49. VIIRS Satellite Image from May 18, 2016	49
Figure 50. Surface Weather Analysis from May 21, 2016	50
Figure 51. Ozone AQI Maps for May 23-24, 2016	50
Figure 52. HYSPLIT Back Trajectories from New England.....	51
Figure 53. HYSPLIT Back Trajectories from Michigan, May 23- 24, 2016.....	51
Figure 54. New York CSAPR Source 2016 Daily NOx Emissions	53
Figure 55. Pennsylvania CSAPR Source 2016 Daily NOx Emissions	53
Figure 56. New Jersey CSAPR Source 2016 Daily NOx Emissions.....	54
Figure 57. Comparing Similar Day Model Output from August 29th to May 25, 2016 with Observed AQI	55
Figure 58. NOAA CMAQ Model Bias Isopleths for May 25, 2016	56
Figure 59. NOAA Model Ozone Forecast vs. Observed for Westport CT.....	57
Figure 60. NOAA Model Ozone Forecast vs. Observed for East Hartford CT.....	57
Figure 61. NOAA Model Ozone Forecast vs. Observed for Cornwall CT.....	58

1. OVERVIEW

1.1 Introduction

On May 1, 2016, a wildfire began southwest of Fort McMurray, Alberta, Canada. On May 3, it swept through the community, destroying approximately 2,400 homes and buildings and forcing the largest wildfire evacuation in Albertan history. The fire spread across approximately 590,000 hectares (1,500,000 acres) before it was declared to be under control on July 5, 2016.

In a [CBC June 14th, 2016 article](#):

"The Fort McMurray wildfire MWF-009, which came to be known across Canada as "The Beast," was not ignited by a lightning strike, and police are now asking for the public's help to determine whether it was the result of a criminal offence.

Provincial wildfire investigators have established that the fire was most likely the result of "human activity."

The fire was first sighted about 15 kilometres southwest of Fort McMurray by an airborne forestry crew on May 1.

Over the next two days, the wildfire grew rapidly. On May 3, pushed by high winds and fuelled by tinder-dry conditions, the fire raged into the city itself and forced more than 80,000 residents to flee."

During the month of May, a large smoke plume meandered through southern Canada and the Upper Great Lakes to New England. From about May 18- May 24th, surface high pressure settles over the upper Mid-Western United States, trapping residual pollutants from the wildfire in the lower boundary layer of the atmosphere. Coincident with this, wildfire plumes extensive agricultural fires in the Yucatan Peninsula in Mexico were being transported northward from winds higher in the boundary layer. Satellite imagery suggests that the two plumes began merging together in the Upper Mid-West States as early of May 13th.

On May 24th, surface temperatures rose high enough to produce conditions ideal for ozone formation around the Great Lakes States, especially in Michigan. On that date, every monitor in Michigan exceedance the 8-hour ozone NAAQS of 70 ppb. On May 25th, the residual wildfire plume, along with elevated ozone levels, were transported to the east and southeast to the Mid-Atlantic States and New England. Some of the highest ozone concentrations for the summer season were monitored there during the May 25-28th timeframe. Weather conditions in the northeastern United States were originally not conducive for ozone formation during May 24-25th and although conditions became more favorable for ozone formation after May 25th, it is evident from our analysis that that the wildfire plumes had a significant effect on the ozone levels for several days and therefore qualifies as an exceptional event.

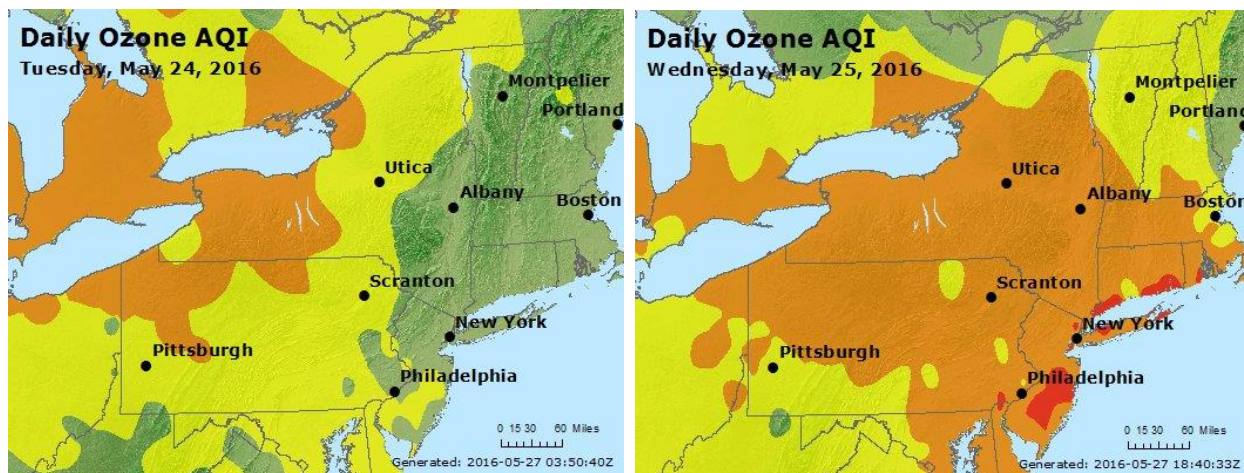


Figure 1. Air Quality Index (AQI) Maps for May 24-25th showing the transport of ozone southeast from the Great Lakes



Figure 2. Wildfires approaching Fort McMurray, Alberta around May 3, 2016

1.2 EPA Exceptional Event Guidance

The Environmental Protection Agency (EPA) revised the Exceptional Events Rule (EER) in October of 2016, based on implementation experiences with the exceptional events data exclusion process. The revised EER states that an exceptional events demonstration must include the following elements:

- 1) A narrative conceptual model that describes the event(s) causing the exceedance or violation and a discussion of how emissions from the event(s) led to the exceedance or violation at the affected monitor(s);
- 2) A demonstration that the event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation;
- 3) Analyses comparing the claimed event-influenced concentration(s) to concentrations at the same monitoring site at other times. The Administrator shall not require a State to prove a specific percentile point in the distribution of data;
- 4) A demonstration that the event was both not reasonably controllable and not reasonably preventable;
- 5) A demonstration that the event was caused by human activity that is unlikely to recur at a particular location or was a natural event; and
- 6) Documentation that the submitting air agency followed the public comment process.

The guidance document introduced the concept of a 3-tier analysis: “Tier 1 clear causal analyses should be used for wildfire events that cause clear O₃ impacts in areas or during times of year that typically experience lower O₃ concentrations, and are thus simpler and less resource intensive than analyses for other events. Tier 2 clear causal analyses are likely appropriate when the impacts of the wildfire on O₃ levels are less clear and require more supportive documentation than Tier 1 analyses. Tier 3 clear causal analyses should be used for events in which the relationship between the wildfire and the O₃ exceedance or violation is more complicated than the relationship in a Tier 2 analysis, and thus would require more supportive documentation than Tier 2 analyses”.

After consulting with our Regional EPA Office, it was determined that a Tier 1 analysis would not be appropriate, because of the remote distance of the fire from Connecticut (~3500 km). To qualify for a Tier 2 analyses, we were required to undertake a ‘Q/D’ calculation. The Q/d analysis is simply a comparison of the ration of Q, the daily tons of VOC and NO_x emitted from the fire, to d, the distance in kilometers from the fire to the point of concern. If the Q/d value compares favorably to analytical data from other fires, then the fire can be presumed to have had a causal effect on ozone concentrations at the point of concern.

EPA guidance indicates that a fire should have a Q/d in excess of 100 tons per day per kilometer (tpd/km) in order to be considered to have a clear causal impact on ozone. EPA developed this

value based on analyses of four fires which occurred in 2011. We present a summary of our analysis here and the complete document is available in Appendix A.

The Alberta government reported that by June 10, 2016 the fire ultimately covered 589,995 hectares (1,457,909 acres) with a perimeter of 996 kilometers (618 miles). For reference, the total land area of Rhode Island is approximately 270,000 hectares.¹ The chart below indicates the total area covered by the fire as reported by the Alberta government². During the week prior to the exceptional event in Connecticut the fire grew by approximately 60,000 hectares (148,263 acres). ‘Q’ is the total daily emission rate in tons per day of reactive hydrocarbons (rHC) and nitrogen oxides (NOx). EPA recommends, in the exceptional events guidance, that only 60% of the hydrocarbons should be considered reactive. Using appropriate emission factors, we estimated that 10,675 tons of rHC were emitted during the period of interest. No adjustments are suggested for the NOx emissions, which were estimated at 2965 tons during that period. Therefore the total rHC and NOx emissions are 10675 + 2965, or 13,640 tons over the six days. On average this results in a daily emission rate, or Q, of 2273 tons per day.

Based on the large distance, we will not present individual analyses for each monitor in Connecticut but estimate the distance from the Fort McMurray fire to the most distant point in Connecticut. We will therefore use a value of d of 3286 kilometers, the flight distance from Fort McMurray to Stonington, CT. Using the values determined above, Q/d then becomes 2273 tpd divided by 3286 km or 0.69 tpd/km. This value is well below the EPA recommended level of 100 tpd/km indicating clear causality. Taking a less conservative approach and using the maximum extent of the burn area over the life of the fire, the result would be a Q/d of 40.8 tpd/km. Still sufficiently below the EPA recommended threshold for establishing clear causality. Noting the wide variability in emissions estimates from different approaches, and as the Q/d method does not generally satisfy the expectation of a clear causal impact, we present other evidence demonstrating that the plume from the Fort McMurray fire caused elevated ozone levels in Connecticut.

¹ Any large area estimate can only be considered comprehensible if compared to the State of Rhode Island.

² <https://www.alberta.ca/release.cfm?xID=41701E7ECBE35-AD48-5793-1642C499FF0DE4CF> [Final Update 39: 2016 Wildfires (June 10 at 4:30 p.m.), Alberta Government]

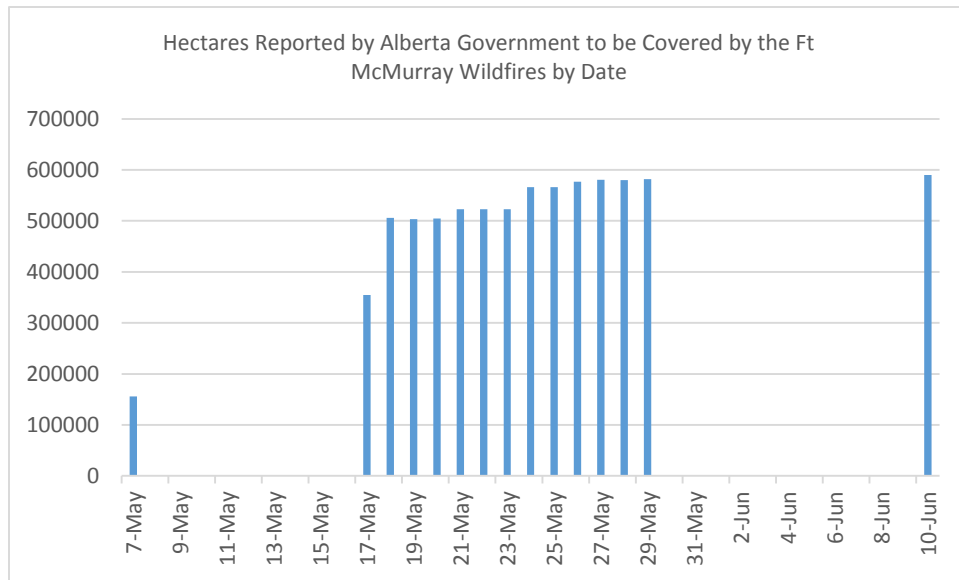


Figure 3. Hectares Burned reported by the Alberta Canada Government.

1.3 Connecticut's Exceptional Event Request

Connecticut's air quality forecasters noted that on May 25th, 2016, there was an unusual area of elevated ozone concentrations over the upper Midwest States to New York State that was being transported to New England. The National Oceanic and Atmospheric Administration (NOAA) operational ozone model had been predicting good to moderate ozone concentrations throughout the area, so it was immediately determined that the elevated ozone was likely due to the interaction with the persistent Fort McMurray wildfire smoke plume that had been residing over those States for several days.

Connecticut air quality monitors reported daily maximum 8-hour average ozone levels over the 70 ppb National Ambient Air Quality Standard (NAAQS) during the May 25-28, 2016 time period. During August of 2016, Connecticut placed an informational flag on all the monitored ozone data for that entire 4-day period, while staff began analyzing the impact of the smoke event on the ozone levels. On September 28th, 2016, Connecticut officially notified the EPA Region 1 Office of our intent to submit an exceptional events' data exclusion demonstration for that time period.

In that letter, we stated that the factors that led us to conclude that the Fort McMurray wildfire influenced the flagged data were:

- Weather patterns were initially not favorable for ozone formation over Connecticut. High pressure trapped pollutants from the wildfire over the upper Great Lakes for several days

before normally clean northwest winds transported 'unhealthy' levels of ozone to the east and southeast across New York State and then to Connecticut;

- Visible satellite plumes and back trajectory analysis before the event showed wildfire smoke transport southeast into the Midwestern States before arriving over Connecticut on May 25th, 2016; and
- The NOAA operational ozone forecast model under-predicted ozone by more than 20 ppb during the period. The under prediction is likely due to the inability of the model to account for the effect of real-time gas-phase smoke emissions from the fire.

Although all four days of the ozone event may have been influenced by the smoke plume chemistry, Connecticut now believes that the days of May 25-26, 2016 unequivocally qualify for an exceptional event data exclusion and will request this exclusion for the four monitors that would have the most regulatory impact, if this data is not excluded.

2. CONCEPTUAL MODEL OF EVENT

2.1 Monitoring Network

Network Overview: DEEP currently operates 14 air monitoring stations in its state-wide network (Figure 4). These include two National Core (NCore) multi-pollutant sites: Criscuolo Park in New Haven, and Mohawk Mountain in Cornwall. In addition, EPA operates an ozone site in Abington, in the town of Pomfret, as part of the Clean Air Status and Trends Network (CASTNET). Table 1 provides a summary of pollutant and meteorological parameters currently monitored in the network.

Ozone is monitored in Connecticut at 12 sites, 11 DEEP State and Local Air Monitoring Stations (SLAMS) and 1 CASTNET, as shown in Figure 5. As of 2017, the ozone monitoring season is March 1 through September 30; previously it was April 1 through September 30.

The DEEP air monitoring network meets the minimum monitoring requirements for criteria pollutants as put forth in Title 40 Part 58 of the Code of Federal Regulations (CFR), Appendix D. More detailed descriptions of the monitoring network are provided in the [Connecticut 2016 Annual Air Monitoring Network Plan](#) and the [Connecticut 2015 Air Monitoring Network Assessment](#).

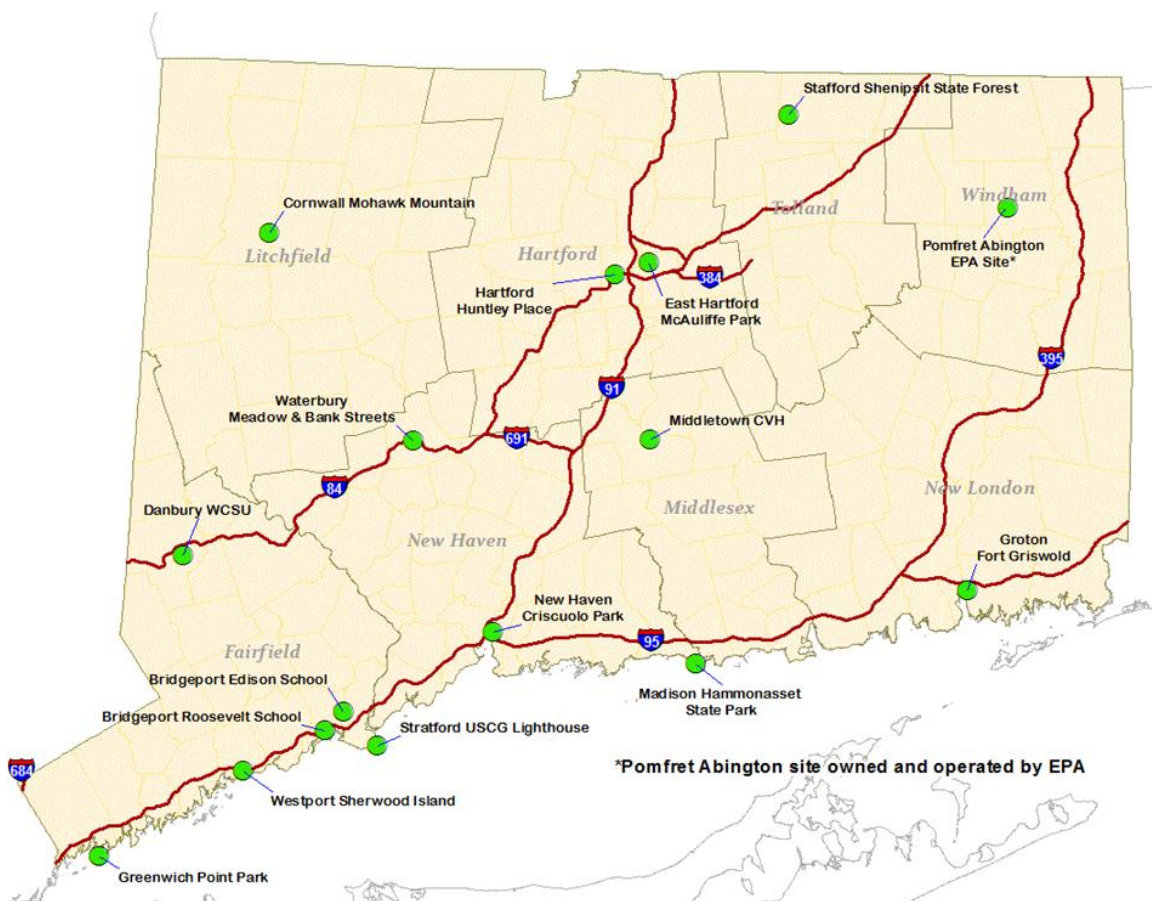


Figure 4. CTDEEP Air Monitoring Network Site Map

Site Descriptions: This exceptional event demonstration is focused on the impacts of the event on 4 monitoring sites that are key in Connecticut's ozone attainment planning efforts. These are: Westport (Sherwood Island State Park), Cornwall (Mohawk Mountain), East Hartford (McAuliffe Park) and Pomfret (Abington).

Pomfret (Abington): AQS ID 09-015-9991; Lat: 41.84046°, Lon: -72.010368°.

The Abington site is a regional-scale site located in a rural/agricultural area in northeast Connecticut in the town of Pomfret. This site is operated by the National Park Service under the direction of EPA as part of their Clean Air Status and Trends Network (CASTNET). It is located on a hilltop approximately 2.3 km south of State Route (SR) 44 and 0.6 km east of SR 97. The site includes a portable shed located in the center of an agricultural field that is surrounded by forest.

Cornwall (Mohawk Mountain): AQS ID: 09-005-0005; Lat: 41.82140°, Lon: -73.29733°.

The Mohawk Mountain site is a regional-scale site located in northwestern Connecticut in the town of Cornwall. The site is located at the summit of Mohawk Mountain with an elevation of

505 m (1656 ft), and is approximately 17 km to the east of the New York border and 25 km to the south of the Massachusetts border.

East Hartford (McAuliffe Park): AQS ID: 09-003-1003; Lat: 42.78471°; Lon: -72.63158°.

The McAuliffe Park site is neighborhood-scale site located in central Connecticut in the town of East Hartford. The site is located approximately 120 m to the east of Rte 5, 2.0 km to the east of I-91 and 2.5 km to the south of I-291. This site is located 3.7 km to the northeast of the city of Hartford. Residential neighborhoods are located in all directions of this site.

Westport (Sherwood Island State Park). AQS ID: 09-001-9003; Lat: 41.11822°; Lon: -73.33681°.

The Westport Sherwood Island State Park site is a regional-scale site located in southwestern Connecticut. This is a coastal site that is approximately 0.5 km to the south of I-95 on the Long Island Sound.

Table 1. List of Connecticut Ambient Air Monitoring Sites and Parameters

Town	Site	PM2.5 (FRM)	PM2.5 (FRM, Collocated)	PM2.5 (Continuous - FEM)	PM10/PM-Coarse (FRM)	PM10/PM-Coarse (FRM, Collocated)	PM10/PM-Coarse (Continuous)	PM Speciation (CSN)	PM Speciation (IMPROVE)	PM2.5 Carbon (BC/UVC, Continuous)	Ozone	SO2	CO	Direct NO ₂	NO/NOy	Traffic Count	Wind Speed	Wind Direction	Temperature	Dew Point / Rel. Humidity	Barometric Pressure	Solar Radiation	Mixing Height
Bridgeport	Roosevelt School		1/6 [†]	X	1/6							X	X						X				
Cornwall	Mohawk Mountain	1/3 [*]		X			X		1/3	X	X	X	X		X		X	X	X	X	X		
Danbury	Western Connecticut State University	1/6		X						X	X						X	X	X		X		
East Hartford	McAuliffe Park	1/6		X	1/6					X	X	X	X	X			X	X	X	X	X	X	
Greenwich	Point Park										X						X	X	X				
Groton	Fort Griswold	1/6		X							X								X				
Hartford	Huntley Place	1/3		X			X			X			X	X		X	X	X	X		X		
Madison	Hammonasset State Park										X						X	X	X				
Middletown	Connecticut Valley Hospital										X						X	X	X				
New Haven	Criscuolo Park	1/3	1/6	X	1/3	1/6	X	1/3		X	X	X	X	X	X		X	X	X	X	X	X	X
Stafford	Shenipsit State Forest										X						X	X	X				
Stratford	Stratford Lighthouse										X								X				
Waterbury	Meadow & Bank Street	1/6		X													X	X	X				
Westport	Sherwood Island State Park										X						X	X	X				

^{*}1 in 3 day sampling schedule

[†]1 in 6 day sampling schedule

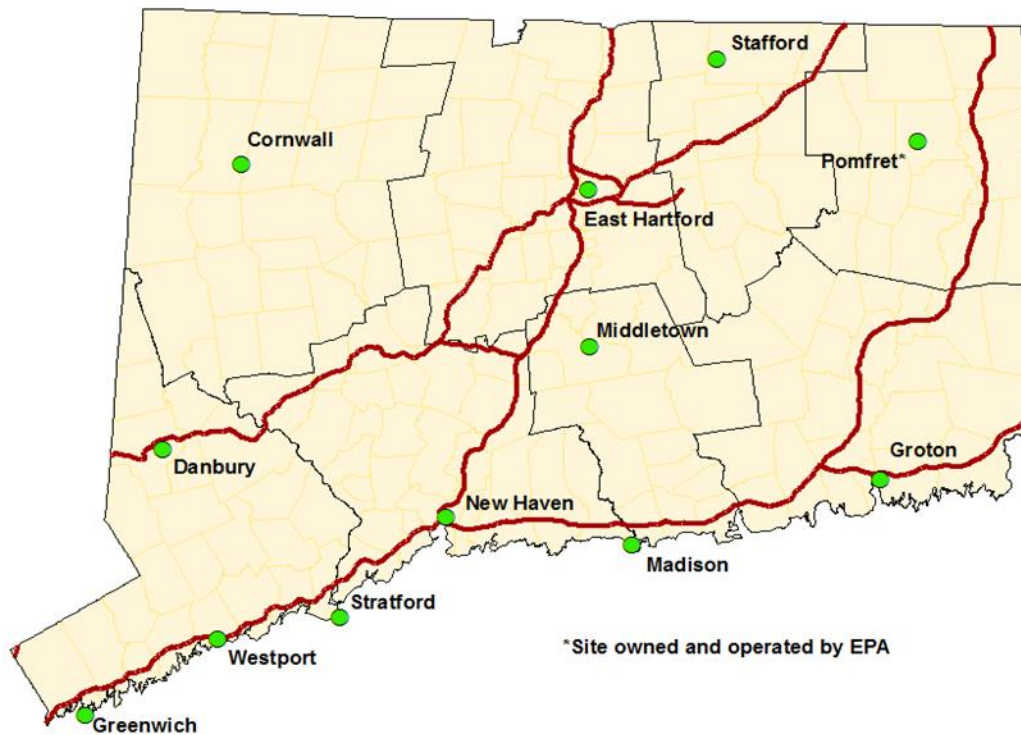


Figure 5. Map of Connecticut's Ozone Monitoring Sites.

2.2 Monitored Data

Table 2 shows the maximum 8-hour ozone averages observed at the Connecticut monitors during this ozone event that occurred during the May 25-28th period. There were monitored exceedances of the 70 ppb ozone NAAQS on all 4 days between May 25-28th, 2016, however the overwhelming influence of the wildfire smoke can only be proven for May 24-25, as is observed in the highest ozone concentrations occurring on those 2 days.

Table 2. Monitored Maximum 8-hour Ozone for Connecticut Sites

Site Name	5/25/2016	5/26/2016	5/27/2016	5/28/2016
Abington	76	83	68	67
Cornwall	81	91	78	65
Danbury	82	99	81	81
East Hartford	75	93	70	81
Greenwich	89	91	63	82
Groton Fort Griswold	87	80	54	60
Madison-Beach Road	89	86	56	63
Middletown	80	91	67	79
New Haven - Criscuolo Park	63	84	65	73
Stafford	74	82	70	73
Stratford	89	76	59	70
Westport	87	90	61	81

2.3 Connecticut Ozone Monitors

This event affects the regulatory determinations for one of the Connecticut monitors, and may have future design value regulatory issues for three more. According to the guidance, an exceptional event can be requested when: *The assignment or re-assignment of a classification category (marginal, moderate, serious, etc.) to a nonattainment area to the extent this is based on a comparison of its “design value” to the established framework for such classifications.* In this case, this ozone event caused the Westport monitor design value to increase to 85 ppb, which is now in violation of the 1997 ozone NAAQS. Figure 6 is a map of the Connecticut ozone monitors with the preliminary 2016 design values.

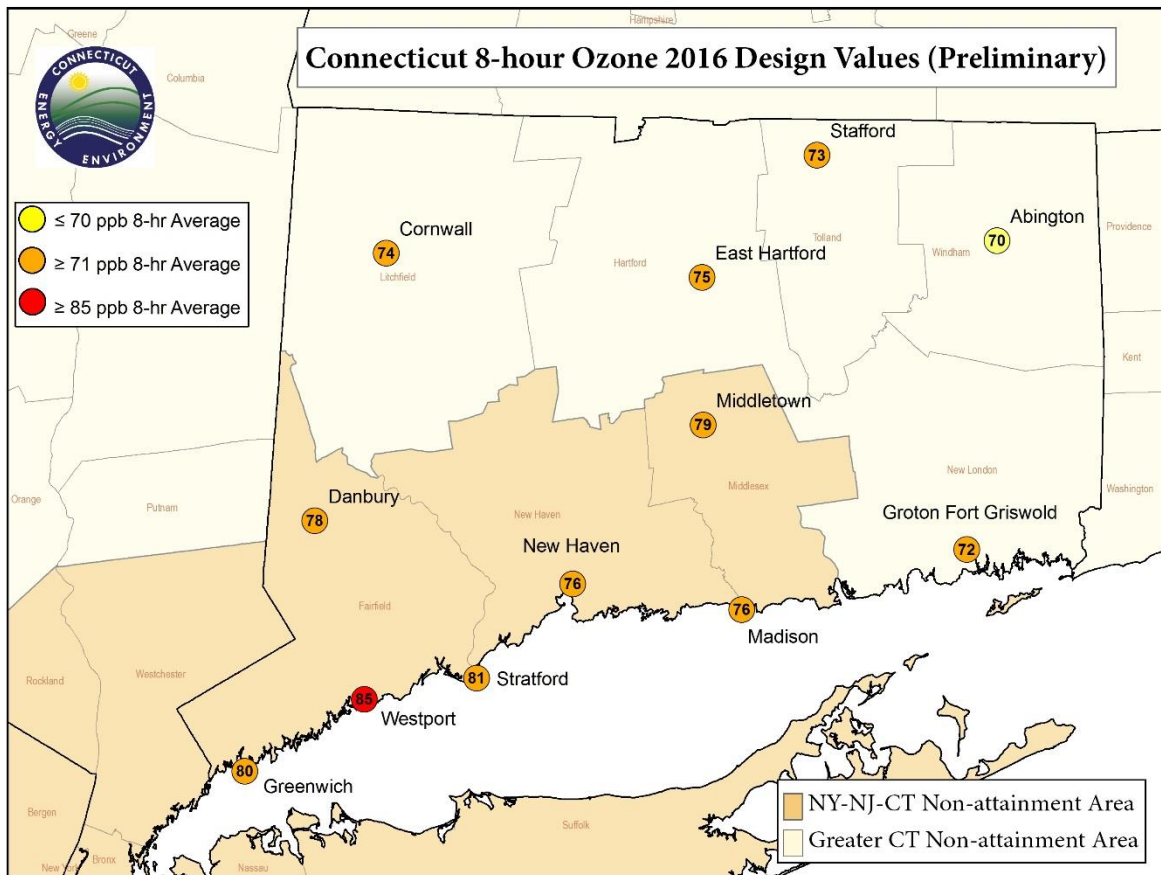


Figure 6. Preliminary 2016 8-hour Ozone Design Values for Connecticut.

Besides our Westport monitor, we are requesting data exclusions for our Abington, Cornwall and East Hartford sites in our great Connecticut non-attainment area. East Hartford and Cornwall are currently in non-attainment for the 2015- 70 ppb NAAQS, but there is concern that these sites could exceed the 2008- 75 ppb NAAQS if future years produce high ozone events. Our Abington site, which is currently in attainment for all the ozone NAAQS, could easily become non-attainment in future years, if this data is not excluded. Table 3 shows how this data exclusion would affect the 2016 design values.

2.4 Monitored Concentrations

Figure 7 shows the hourly ozone concentrations for the four monitors in question. It can be noted that May 24th showed very low ozone levels before spiking up on May 25th and May 26th. Although very high hourly concentrations were reported again at our East Hartford and Westport sites on May 28th, ozone transport from the I-95 corridor became a major factor and it would be difficult to estimate any lingering effects from the wildfire plume.

Table 3. Preliminary 2016 Design Values vs. Revised Design Values with Data Exclusion

	DV 2014	DV 2015	Preliminary DV 2016	2016 daily 8-hour Maximum Ozone (ppb) Excluding May 25-26				2014	2015	Revised 2016
Site Name				1st Max	2nd Max	3rd Max	4th Max	4th Max	4th Max	DV
Greenwich/O3**	82	81	80	87	85	81	79	78	84	80
Danbury/O3	78	76	78	87	81	81	80	74	79	77
Stratford/O3	84	83	81	96	84	83	82	74	86	80
Westport/O3 *	85	84	85	97	87	87	81	81	87	83 *
East Hartford/O3 *	77	76	75	81	76	72	72	77	75	74 *
Middletown/O3	81	80	79	100	84	80	79	80	78	79
Stafford/O3	80	76	73	73	72	71	70	77	72	73
Cornwall/O3 *	69	70	74	79	78	75	74	66	76	72 *
New Haven/O3	76	76	76	91	80	75	75	72	81	76
Groton Fort /O3	79	75	72	82	75	75	75	65	77	72
Abington/O3 *	70	68	70	87	74	68	67	67	70	68 *
Madison/O3	81	78	76	82	80	78	78	69	81	76
* = Monitors of regulatory concern. **= Greenwich revisions reflect invalidated O3 data from 4/1/16 0:00 – 6/14/16 8:00.		DV Violations Classification		70 ppb NAAQS		75 ppb NAAQS		84 ppb NAAQS		

Fine Particulate Matter (PM_{2.5}) likewise showed an upward trend during the May 25-28, 2016 time period. This trend would be expected when a smoke plume interacts with the surface, although concentrations are generally much higher when a wildfire plume is nearby. Figure 8 shows the hourly PM_{2.5} concentrations for Connecticut monitors during this period. Higher order polynomial trend lines were inserted for the New Haven and Bridgeport monitors to show the upward shift from the pre-event baseline.

At our New Haven monitoring site, a CL51 ceilometer is also operating. The BLVIEW software produces a graphical aerosol backscatter image and has an algorithm that calculates up to three boundary layer heights from the maximum backscatter gradient estimate. The time series of the aerosol backscatter is presented in Figure 9, along with the hourly monitored PM_{2.5} concentrations at the New Haven monitor. The time series shows an unusually dense region of aerosols reaching a height over 2 kilometers. This coincides exactly with the increase in monitored PM_{2.5} and the arrival of the smoke plume over Connecticut on May 25th. Other monitored parameters that show the possible presence of a smoke plume include black carbon (BC), deltaC, and carbon monoxide (CO). DeltaC is an Aethalometer “Delta-C” (UV-C minus BC) signal calculation that is a reliable indicative of wood smoke. Our Cornwall monitor, in the northwest corner of the State, was one of the first sites to encounter evidence of smoke related pollutants. Although not high by close by wildfire standards, the trends are consistent with what would be expected from a smoke plume. Figure 10 plots these pollutant trend alongside the hourly ozone concentrations. As noted on the chart, these other parameters have been scaled to more easily show trends against the monitored ozone. DeltaC, indicative of wood smoke shows large upward spikes starting on May 25th and BC shows an upward trend. CO trends upward and increases on the order of 50% from the previous four days. Additional monitoring data from upwind sites will be presented later that will further confirm these pollutant trends.

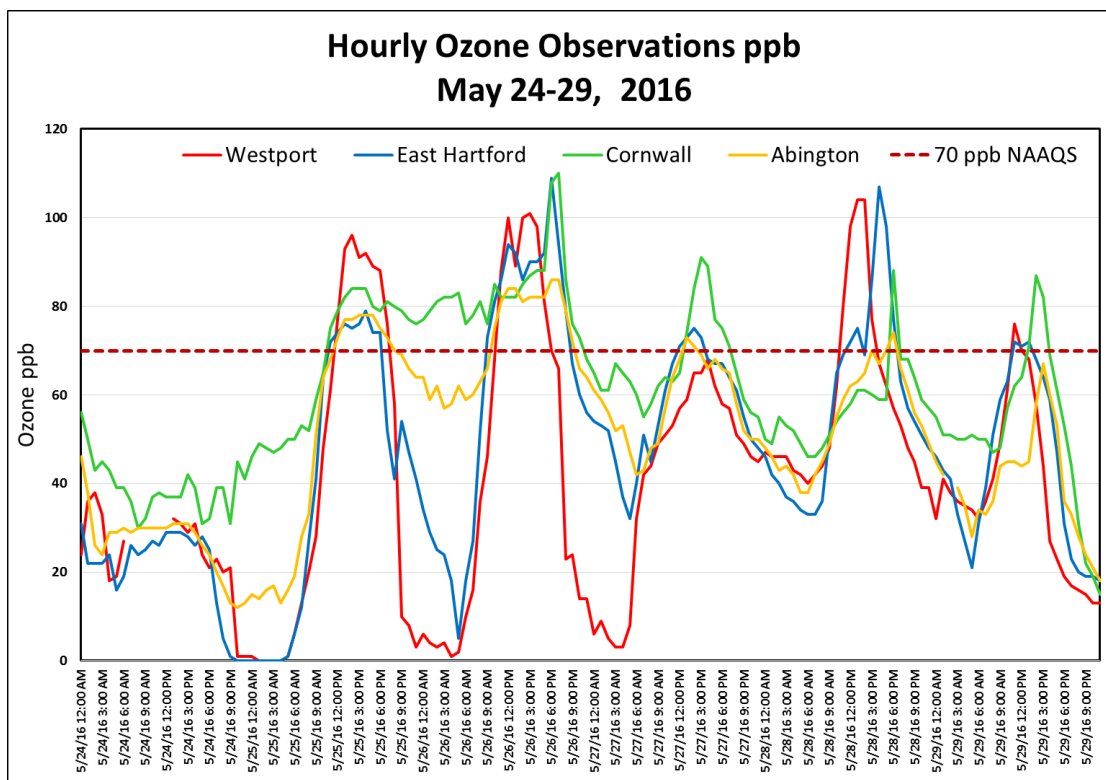


Figure 7. Hourly Ozone Concentrations for May 24-29, 2016

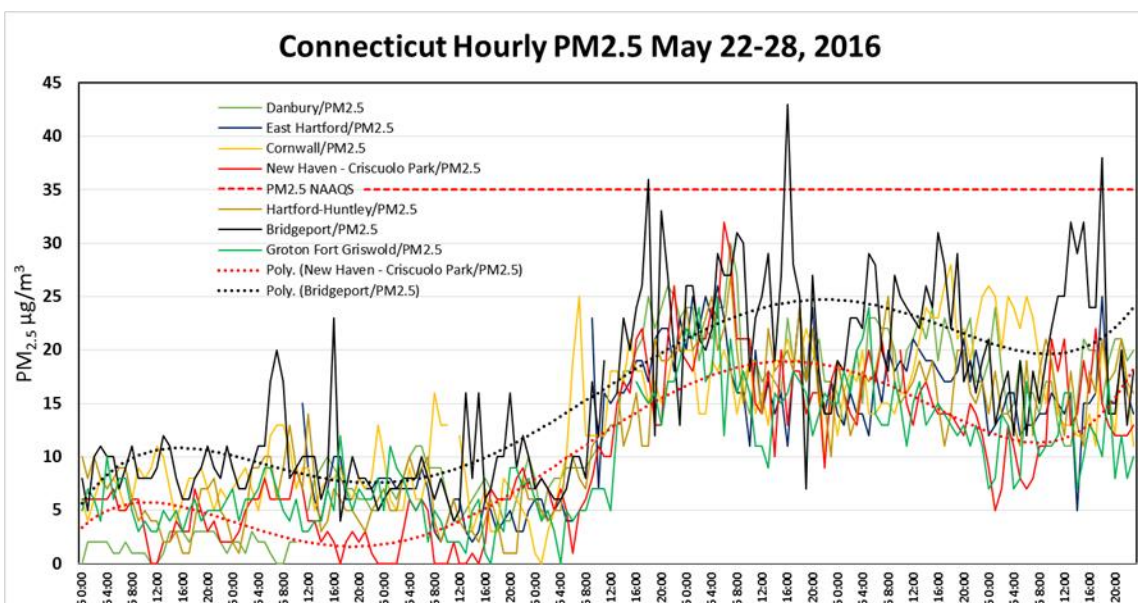


Figure 8. Hourly PM_{2.5} Concentrations in Connecticut for May 22-28, 2016

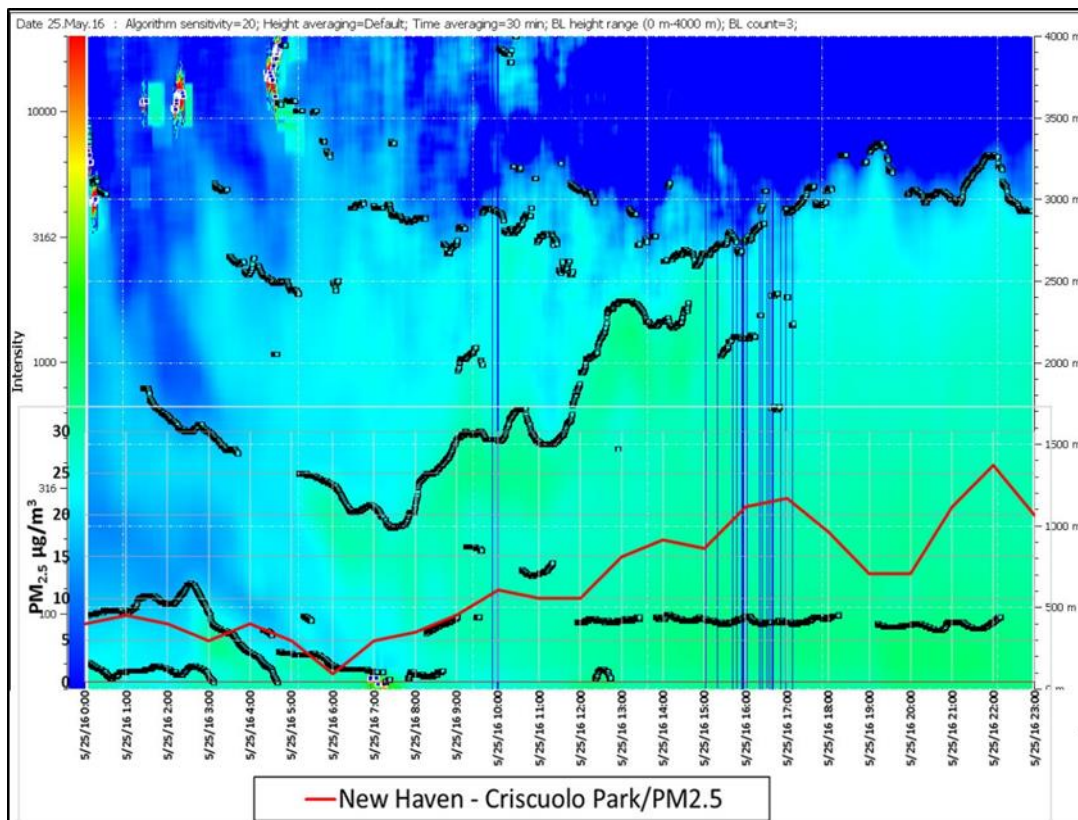


Figure 10. Aerosol Backscatter Intensity over New Haven with PM2.5 Levels

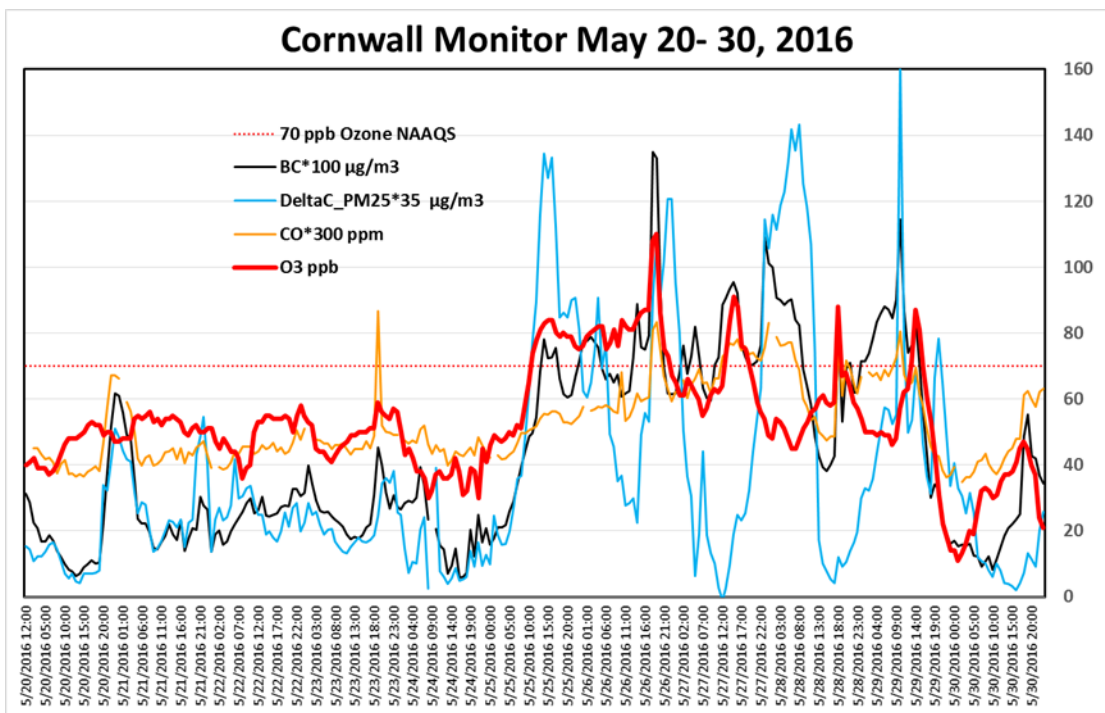


Figure 9. Monitored Black Carbon (BC), DeltaC PM2.5, Carbon Monoxide (CO) and Ozone at the Cornwall CT Monitor

2.5 Meteorological Scenarios

Although Connecticut experiences frequent ozone exceedance days during the summer, they can be quite variable from year to year, due to the prevailing meteorology that develops. In recent years it can also be noted that upwind emissions to Connecticut that cause ozone has also decreased, which has lowered the absolute number of exceedance days, but the meteorological variation is still an important factor. Figure 11 shows the historical trends for Connecticut's ozone exceedance days with separate lines for each of the 8-hour ozone NAAQS since 1997.

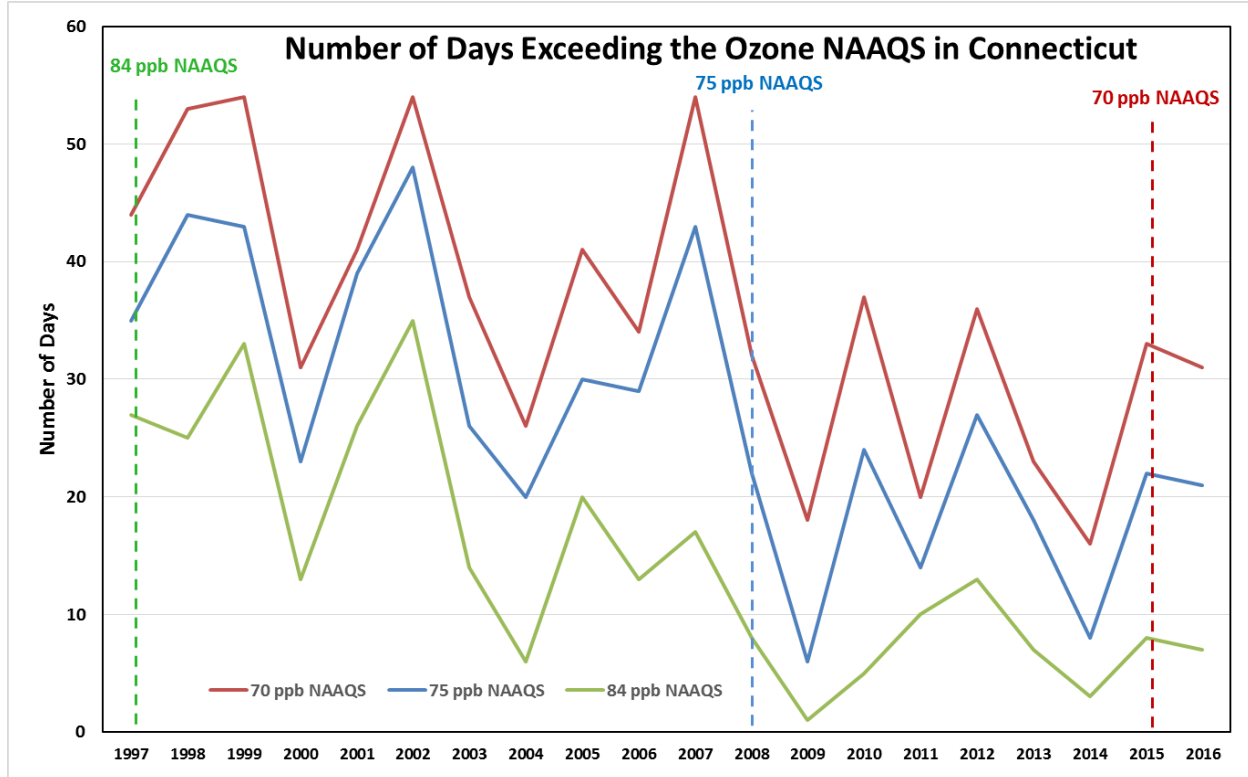


Figure 11. Number of Ozone Exceedance Days in Connecticut Ozone Monitors Since 1997

Typically, the bulk of the ozone exceedance days occur during the June-August timeframe, but frequent exceedances have also occurred during May and September. Occasional exceedances have occurred April, but they do not occur every year.

Ozone exceedances in Connecticut can be classified into four categories based on spatial patterns of measured ozone and the contributing meteorological conditions. Typically, most exceedances occur on sunny summer days with inland maximum surface temperatures approaching or above 90°F, surface winds from the south and west (favorable for transport of pollutants from the Northeast Megalopolis) and aloft winds from the west to southwest (favorable for transport of pollutants from Midwest power plants).

Inland-only Exceedances: Ozone is transported aloft from the west and mixed down to the surface as daytime heating occurs. At times, transport from the southwest can also occur overnight at lower levels aloft due to the formation of a nocturnal jet. Strong southerly surface

winds during the day bring in clean maritime air from the Atlantic Ocean, resulting in relatively low ozone levels along the coast. The maritime front may not penetrate very far inland, and therefore does not mitigate transported and local pollutants' contribution to inland exceedances.

Coastal-only Exceedances: Strong westerly surface winds transport dirty air down Long Island Sound from source regions to the west (e.g., New York and New Jersey). The relatively cool waters of Long Island Sound confine the pollutants in the shallow marine boundary layer. Afternoon heating over coastal land creates a sea breeze with a southerly component, resulting in ozone exceedances along the coast. Inland winds from the west prevent sea breeze penetration and can sometimes contribute to the formation of a convergence zone that can further concentrate ozone along the coast.

Western Boundary-only Exceedances: Southerly maritime surface flow invades the eastern two-thirds of Connecticut, keeping ozone levels in that portion of the state low. The south-southwest urban winds out of New York City result in exceedances along Connecticut's western boundary. Winds aloft are often weak for this scenario.

State-wide Exceedances: This is the classical worst-case pattern, with flow at the surface in the Northeast up the Interstate-95 corridor, transport at mid-levels also from the southwest via the low level jet and flow at upper levels from the west. All of these flows are from emission-rich upwind areas, serving to transport ozone precursors and previously formed ozone into Connecticut. A weak sea breeze may also develop, which would transport ozone pooling over Long Island Sound into the State. The magnitude of the May 25-26, 2016 ozone event over Connecticut would have been representative of this type of scenario (Figure 12), however these meteorological conditions were not present, as will be described later.

2.8 Meteorological Conditions

Weather conditions were dominated by strong high pressure over the Great Lakes early in the period, with weak low pressure passing off the New England coast (Figure 13). The high pressure center over the Great Lakes was responsible for trapping pollutants from the wild fire plumes in the boundary layer while surface temperature began to heat up. Low pressure off the New England coast produced numerous showers over southern New England on May 24th with northeast winds and mild temperatures. By May 25th, the skies cleared over New England and winds were mostly from the northwest throughout the boundary layer.

Of special interest are the 850 mb height maps, since this is high enough in the boundary layer (~1500m) that long range transport can occur. In Figure 14 we observed that the aerosol plume extended up to 3000 meters, so the 850mb winds would be a good indicator for long range transport. In Figure 14, it is observed that there is an 850mb low pressure trough off the U.S. east coast. The airshed for western New York and western New England originates in Quebec and Ontario on May 23- 24th, which is typically a clean air mass, absent of wild fires.

By May 25th, the air flow loops around from Michigan, before turning southeast into New York and Connecticut. On May 26th, the transported boundary layer air flows from the Ohio River

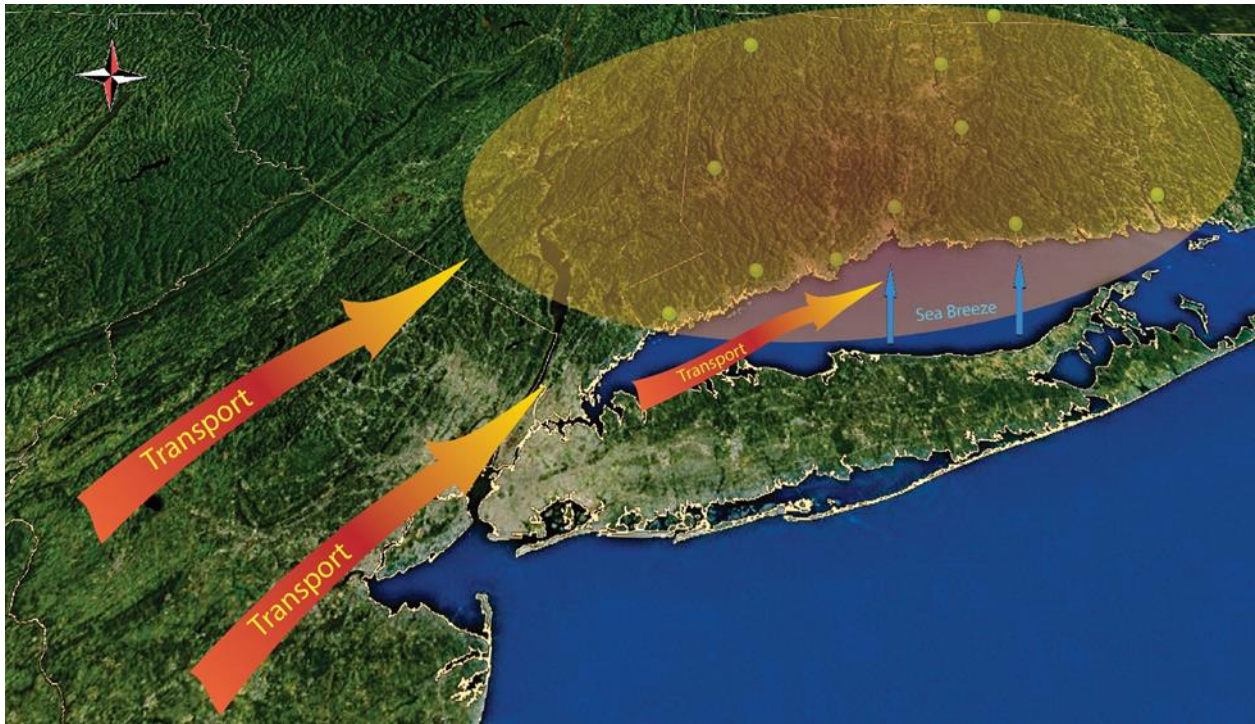


Figure 12. State-wide Ozone Exceedance Scenario

Valley before turning east-southeast into Connecticut. After this, the upper level flow becomes more indicative of what is expected for an 'I-95' corridor ozone event from May 27th onward.

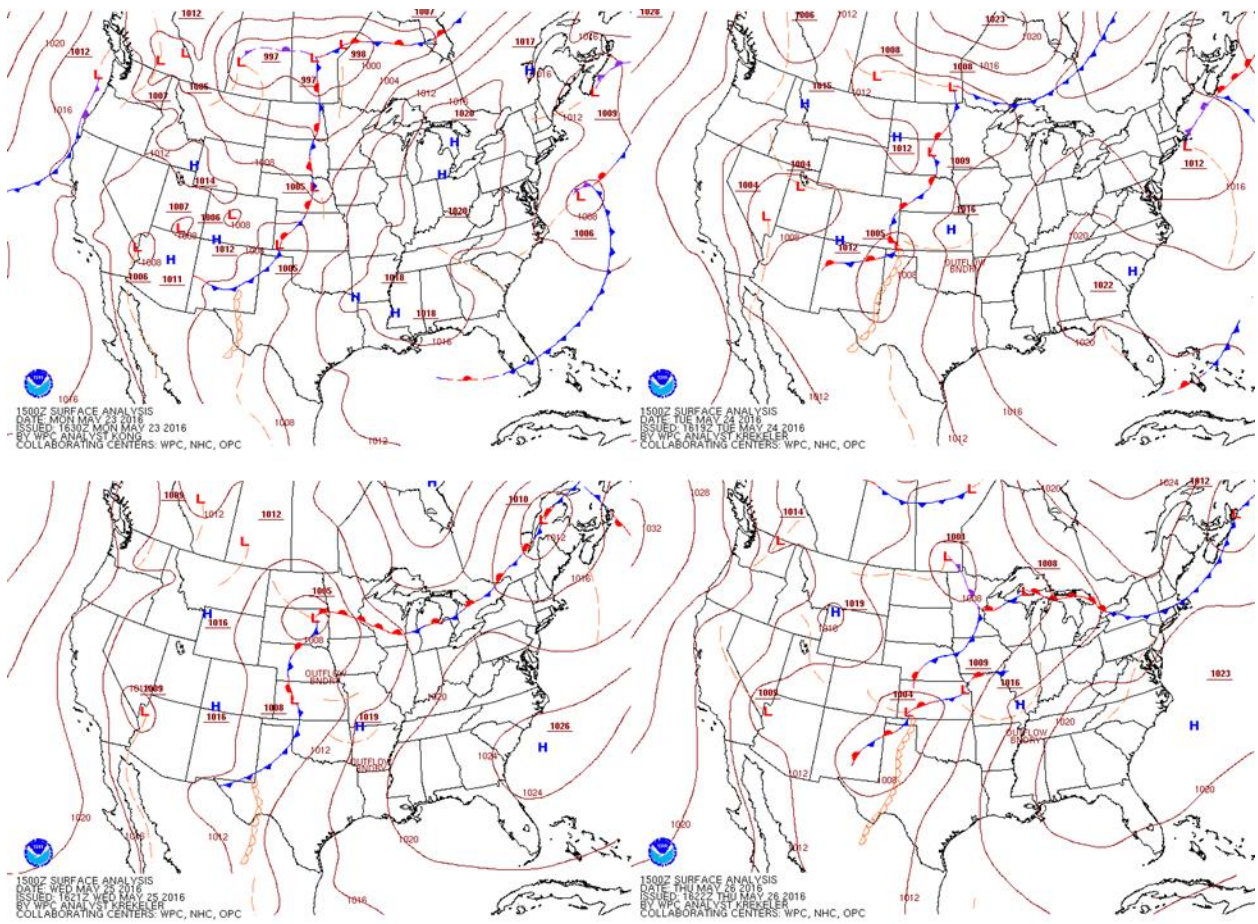


Figure 13. Surface Fronts May 23-26, 2016

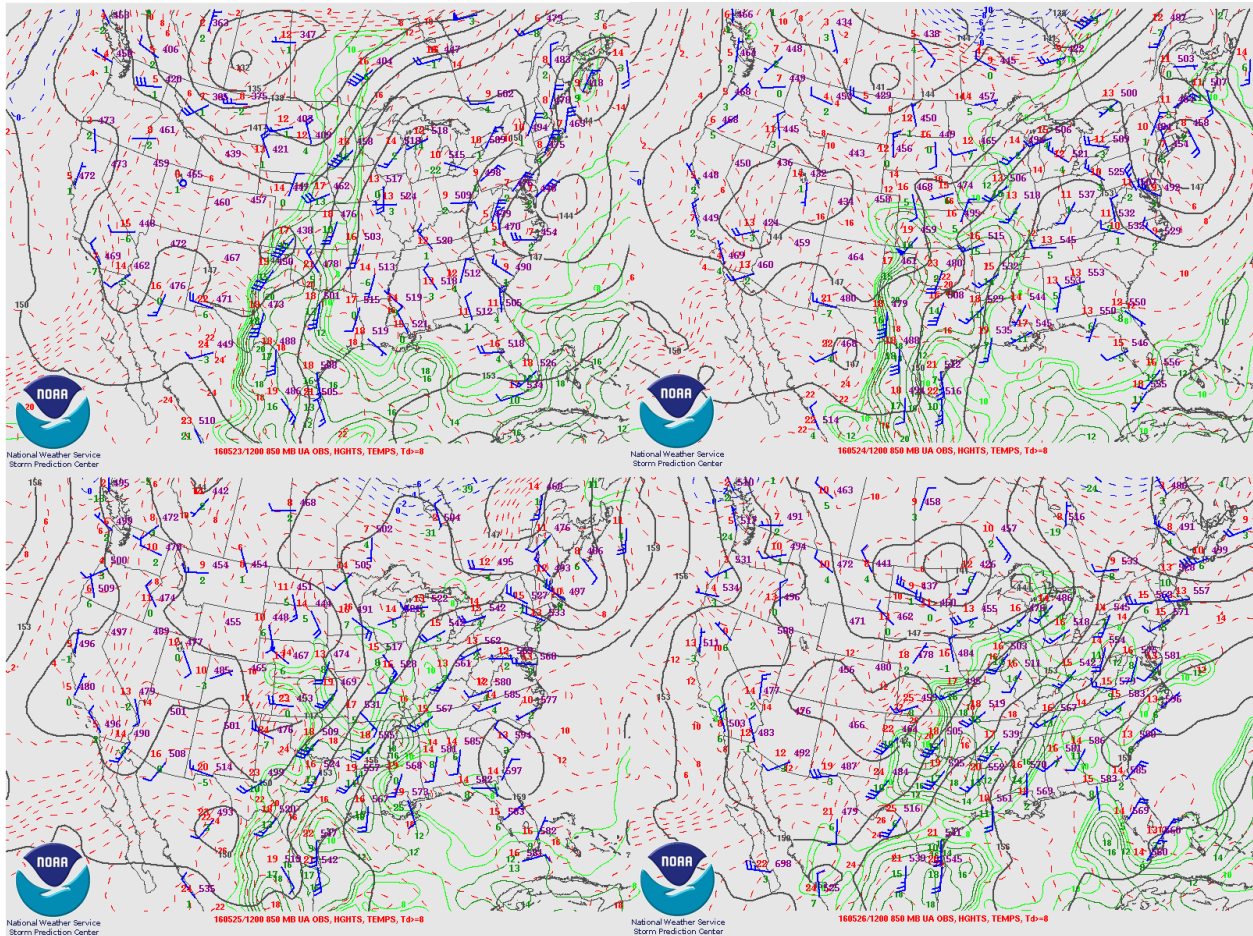


Figure 14. 850mb Heights, Temperatures and Wind Flow for May 23-26, 2016

3. CLEAR CAUSAL WEIGHT OF EVIDENCE

3.1 Satellite Photos, Webcams and Plume Analysis

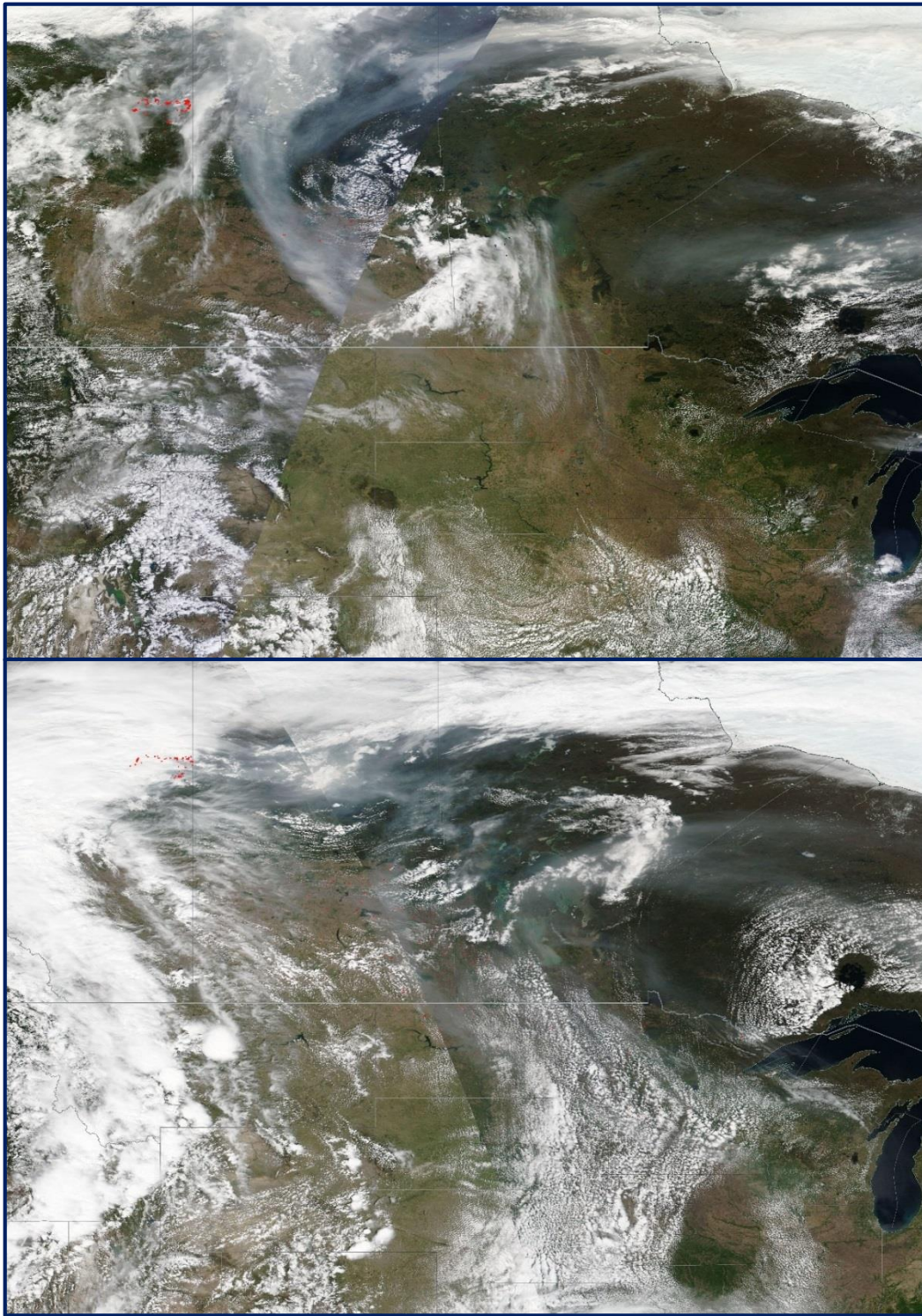


Figure 15. MODIS Satellite Photos Showing Visible Plume over Northern Great Lakes, May 18-19, 2016

It has been well documented that smoke plumes contain gases including non-methane hydrocarbons (NMHCs), carbon monoxide (CO), and nitrogen oxides (NO_x), as well as large amounts of aerosols, which are important precursors to photochemical production of tropospheric ozone (O₃). The impact of wildfires on O₃ level on downwind regions can vary significantly with the magnitude of aged plumes, the amount of biomass consumed and the emissions produced, fuel type, burning area, and combustion conditions (Jaffe et al., 2003, 2008; Martin et al., 2006). Jaffe and Wigder³ and others have confirmed that the maximum O₃ production is often observed substantially downwind of the fire, after the smoke plumes have aged for several days. Dreesen et al (2016) have noted in their analysis of a June 2015 wildfire ozone enhancement in Maryland that at peak smoke concentrations in Maryland, wildfire-attributable Volatile Organic Compounds (VOCs) more than doubled, while non-NO_x oxides of nitrogen (NO_z) tripled, suggesting long range transport of NO_x within the smoke plume. They also noted that ozone peaks a few days after the maximum plume due to ultra violet (UV) light attenuation, lower temperatures, and non-optimal surface layer composition.

Figure 15 shows the presence of the smoke plume over the Upper Midwest states several days before arriving in Connecticut. The presence of a surface high pressure center allowed these pollutants to become trapped while conditions became conducive for ozone formation by May 23-24th. Figure 16 shows the aerosol optical depth (AOD) images, taken by the VIIRS satellite on May 24-25th, which is associated with the particulate matter transported with the plume over the Northeast States.

Figure 17 shows the progression of the smoke plume as analyzed by the Hazard Mapping System (HMS) staff using the satellite images. Of note was the presence of a smoke plume from the southern States and Mexico that merged with the Fort McMurray, Alberta wildfire plume.

Figure 18 are webcams from our Cornwall CT monitoring site that shows the smoke from the plume increasing on May 25-26th. Figure 19 shows images from our Talcott Mountain webcam pointing east toward Hartford. May 24th shows a clean air mass with good visibility while the smoke obscures the sky on May 25-26th.

³ Jaffe, D.; Wigder, N. Ozone production from wildfires: A critical review. *Atmos. Environ.* 2012, 51, 1–10

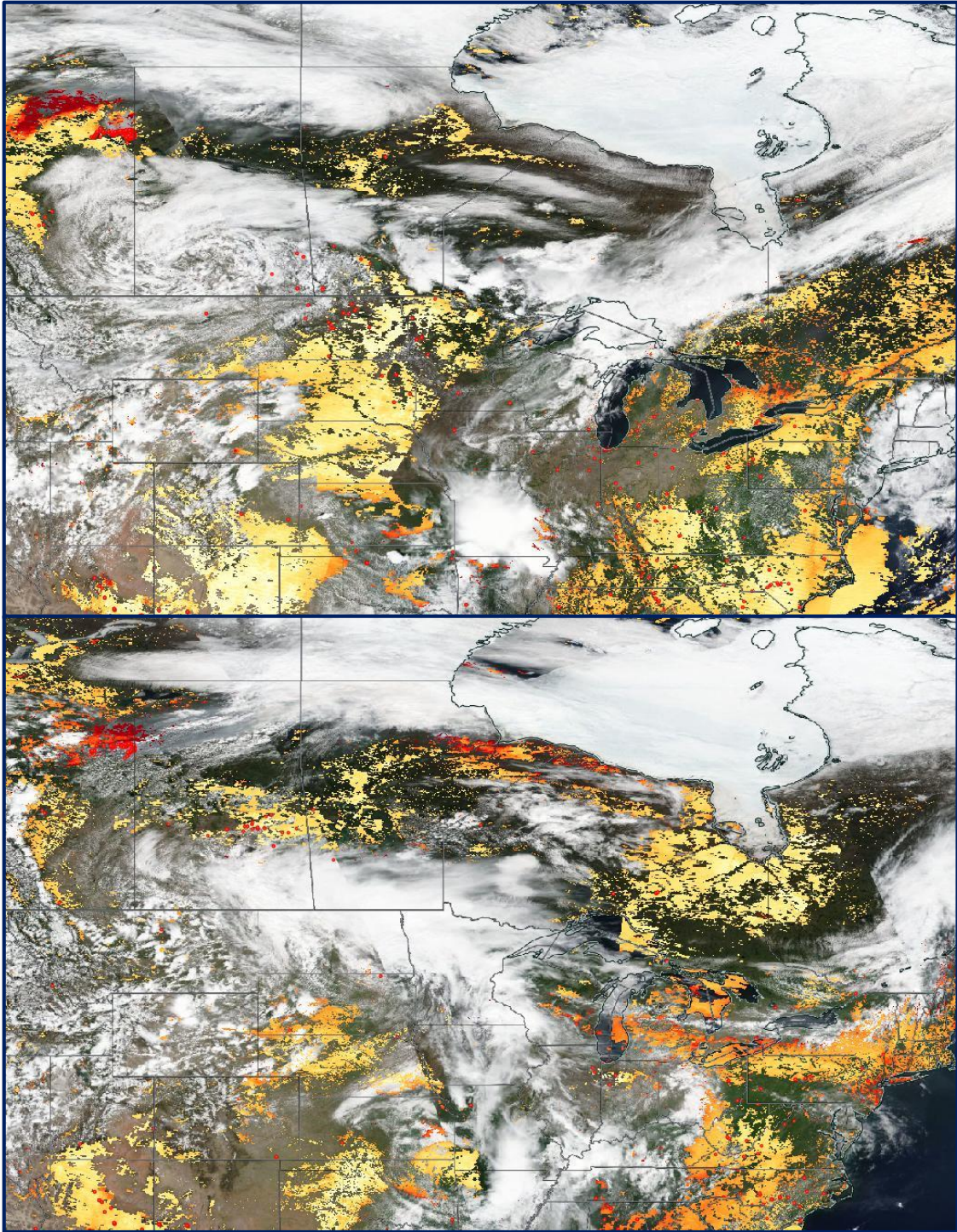


Figure 16. VIIRS Satellite Images for May 25-26, 2016, showing the Analyzed Aerosol Optical Depth (AOD) Associated with the Smoke Plume.

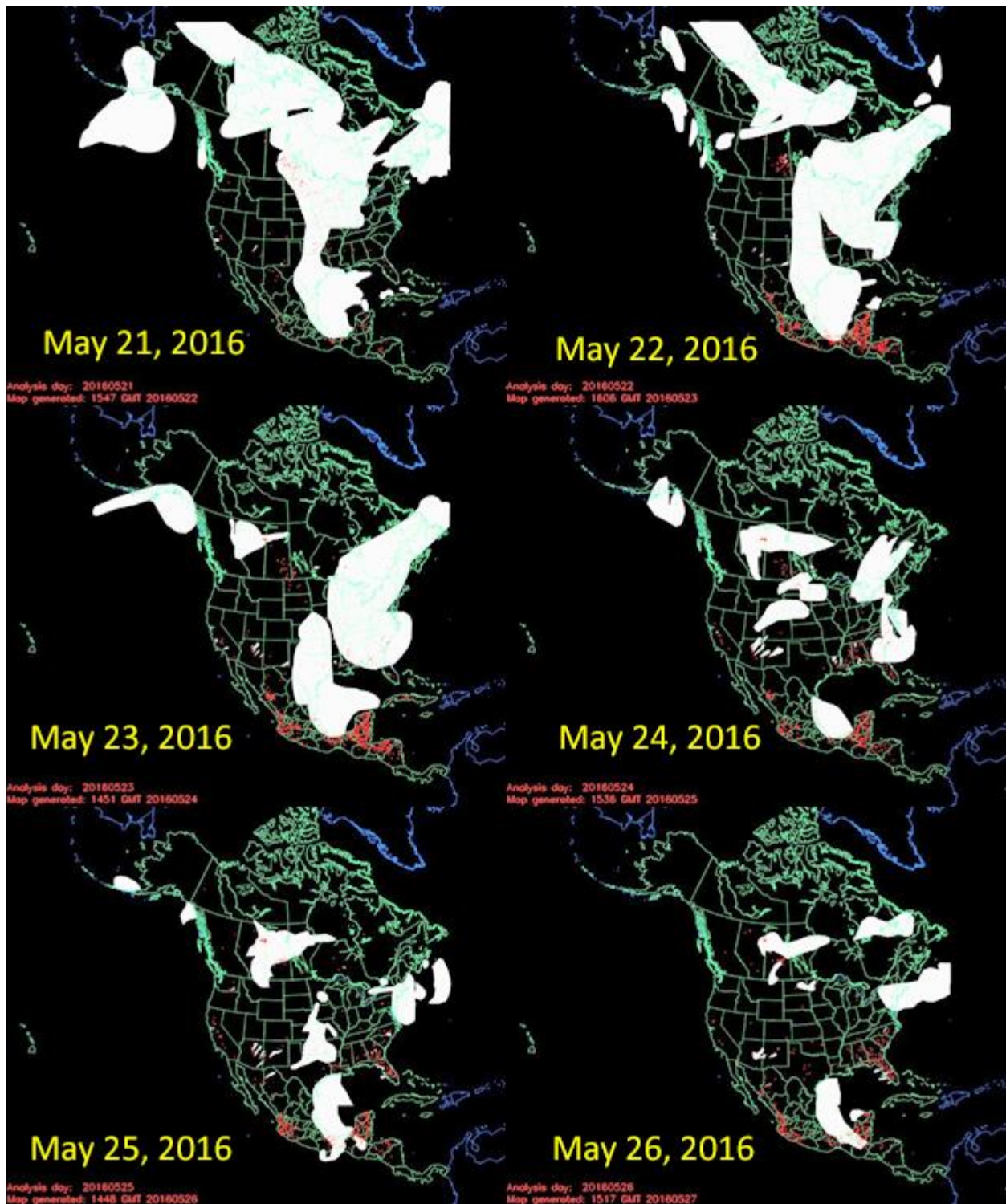


Figure 17. HMS Smoke Analysis from May 21-26th, 2016.



Figure 18. Cornwall Connecticut Webcam May 24-26, 2016

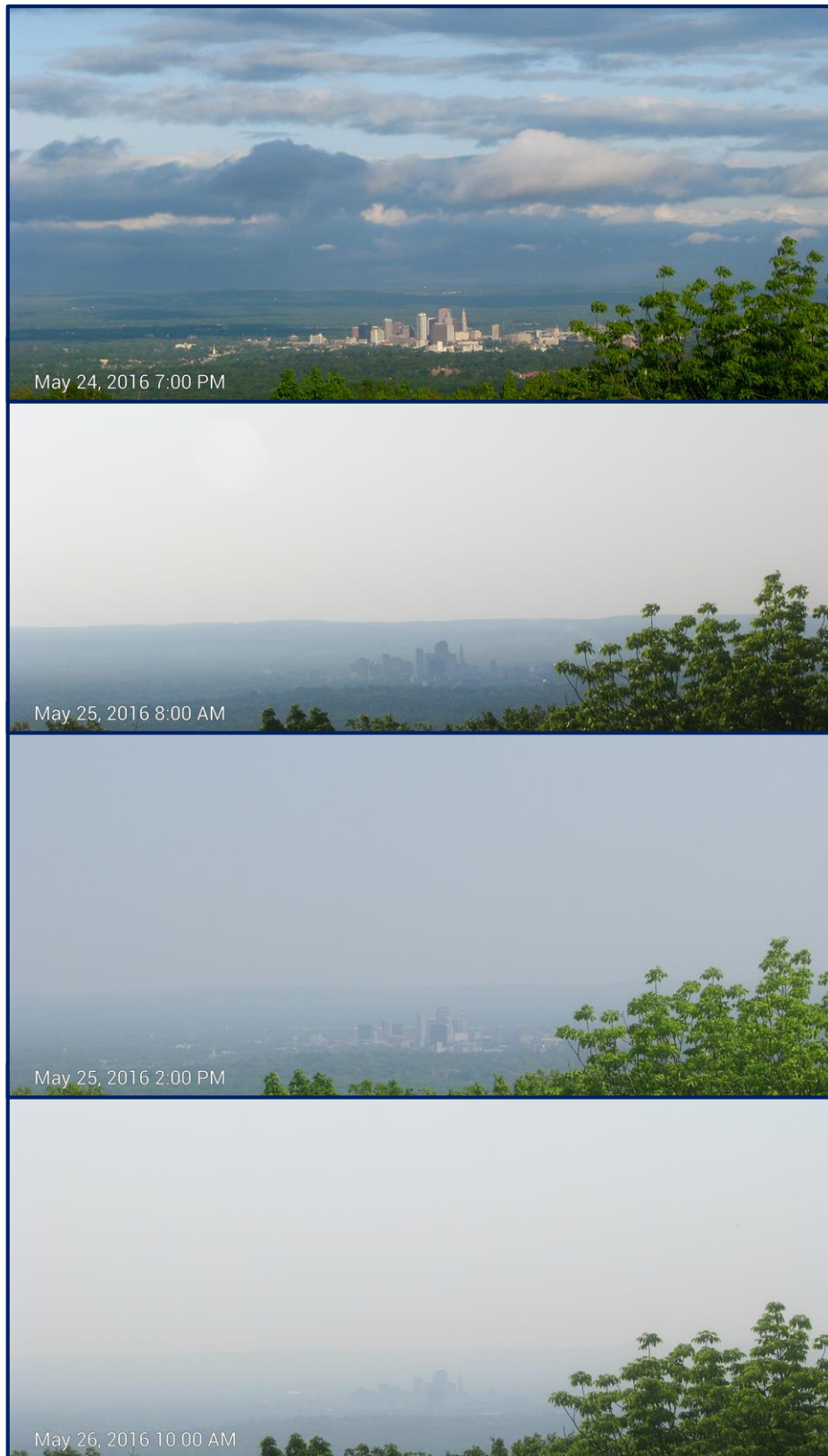


Figure 19. Talcott Mountain Connecticut Webcam May 24-26, 2016

Carbon Monoxide Plumes

Further evidence of smoke plumes can be found in the satellite detection of carbon monoxide (CO), which is a by-product of combustion. The Fort McMurray plume can be seen very distinctly as it meanders across eastern North America. (Figure 20). The plumes disperses over the Great Lakes by May 21st and evidence of the southern U.S. plume can be seen merging with

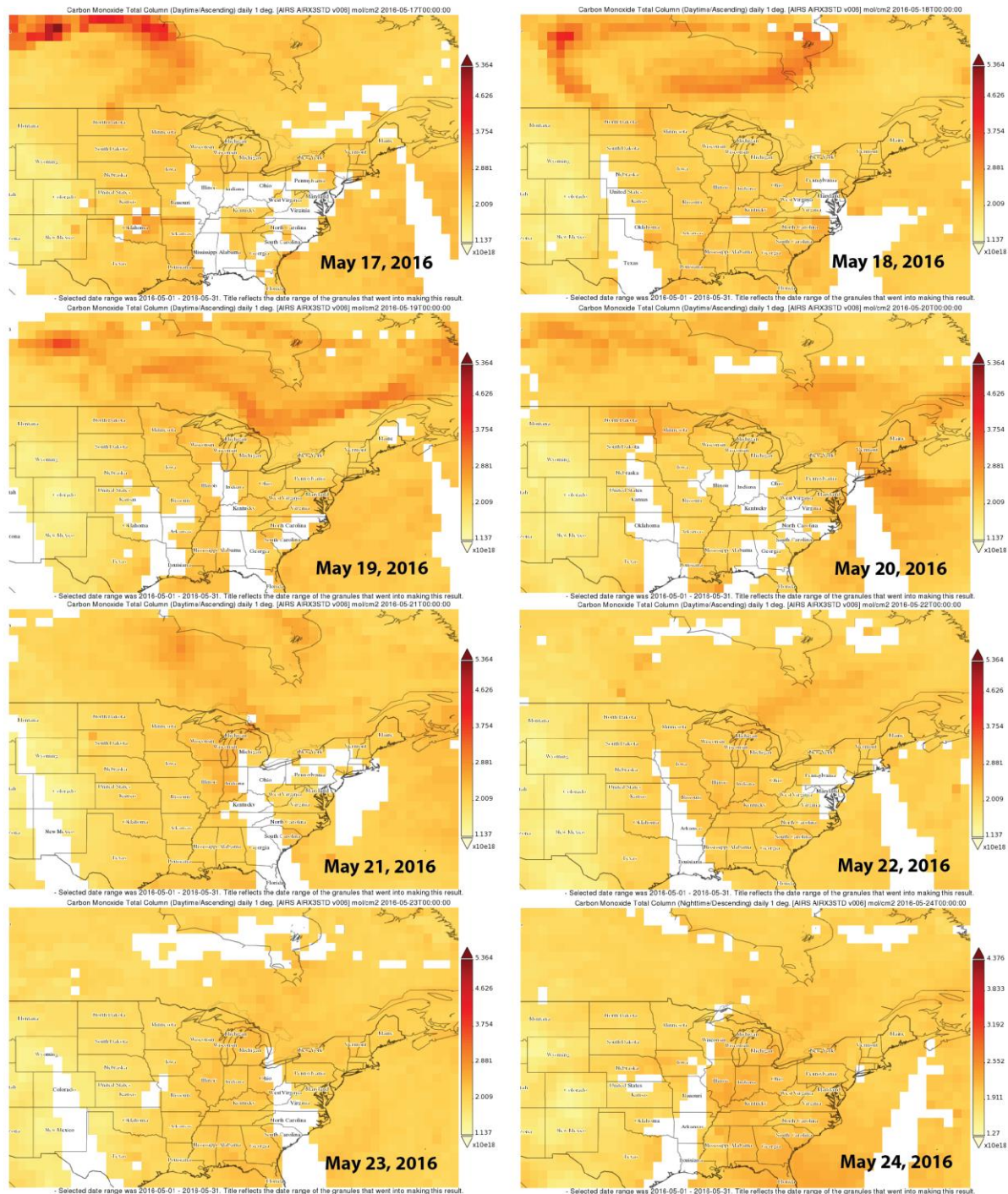


Figure 20. OMI Satellite Carbon Monoxide Plume May 17-24, 2016

this on May 23-24th. A visible smoke plume was seen over Connecticut on May 20th, but did not reach the ground. The May 20th AOD image in Figure 21 is consistent with the CO plume location over Connecticut.

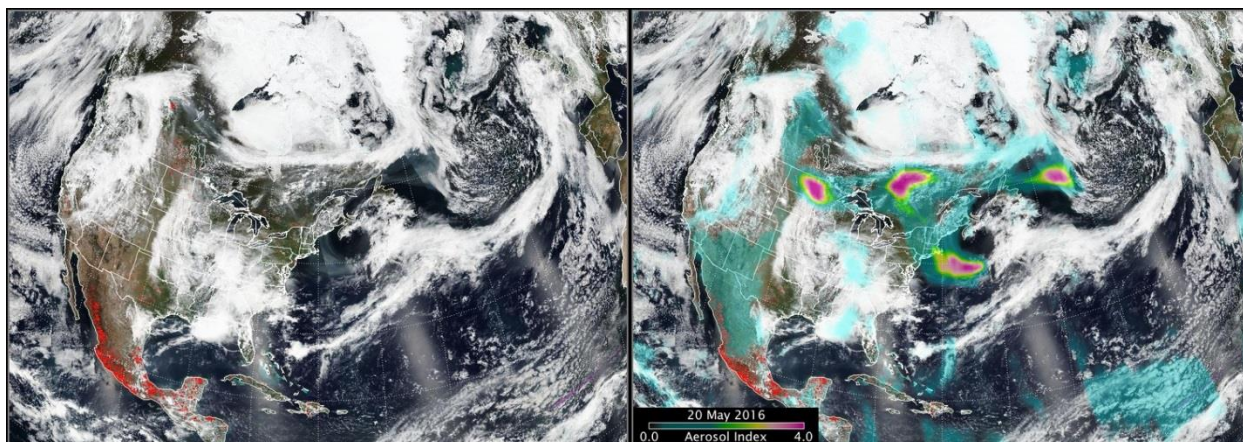


Figure 21. May 20, 2016 VIIRS Satellite Images: Visible on left; AOD on right

3.2 Percentile Rankings

EPA guidance suggests that for each monitor requested for data exclusion, a 5-year percentile of the data on a per monitor basis be determined. If the flagged data is above the 99th or higher percentile of the 5-year distribution of ozone monitoring data, or is one of the four highest ozone concentrations within 1 year, these data can be considered outliers and would provide strong evidence for the event. However, ozone exceedances are so common in Connecticut that our EPA Region 1 Office commented that *“Although meeting these criteria may be difficult for all of the ozone monitors in Connecticut, you may be able to show that the high ozone concentrations measured directly upwind during episode in western Massachusetts, southern Vermont and upstate New York were truly unique over the last 5-8 years.”* We will later present the case for the New York Connecticut Hill monitor, where this event was indeed much more of an outlier.

The following table shows the maximum 8-hour daily ozone levels observed at our four sites compared with the 99th percentile ranked 8-hour ozone levels observed during the last five years. It can be noted that all four sites had a 99th percentile ranking for one or more of these two days.

Table 4. 99th Percentile Rankings for May 25-26th, 2016

Maximum Daily 8-hour Ozone ppb			
Site	May 25 ppb	May 26 ppb	99th Percentile
Abington CT	76	83	74
Cornwall CT	81	91	79
East Hartford CT	75	93	78
Westport CT	87	90	90

The following figures (22-25) are plots of the ranked percentile 8-hour ozone observations at each site to further illustrate the outlier status of the May 25-26, 2016 event.

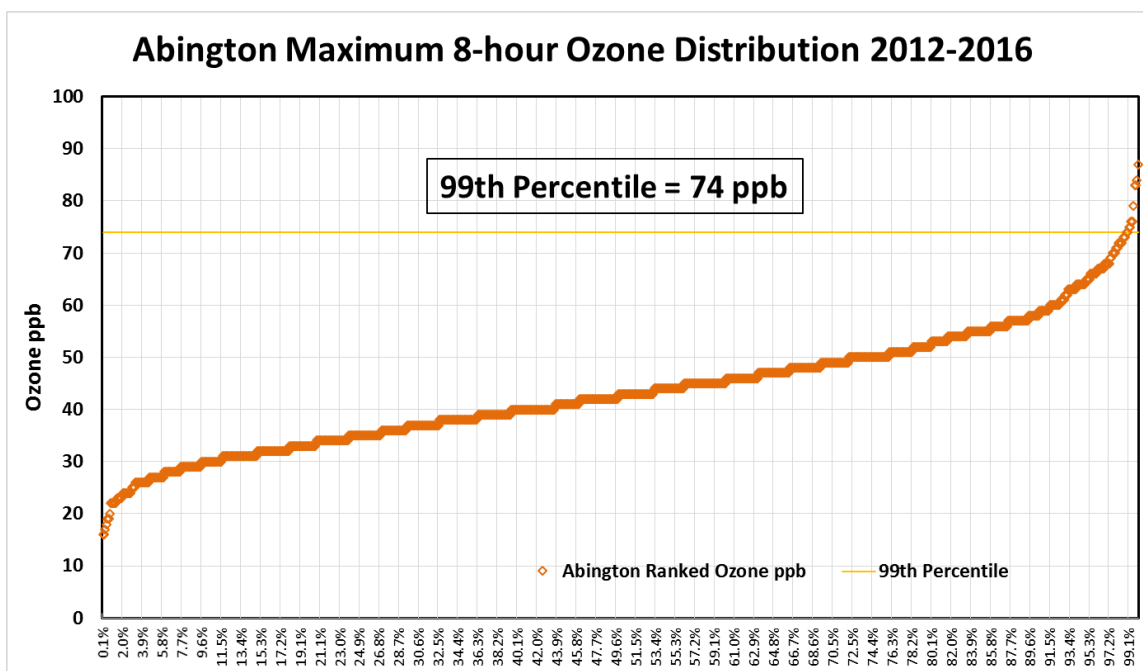


Figure 22. Ranked 8-hour Ozone Distribution for Abington CT 2012-2016

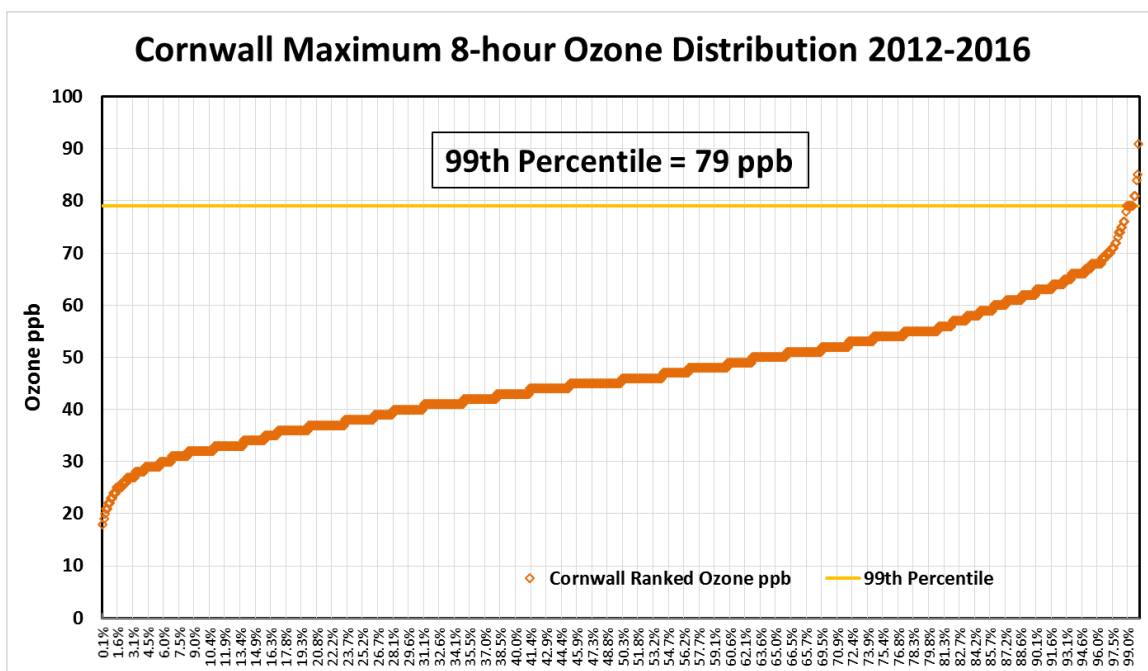


Figure 23. Ranked 8-hour Ozone Distribution for Cornwall CT 2012-2016

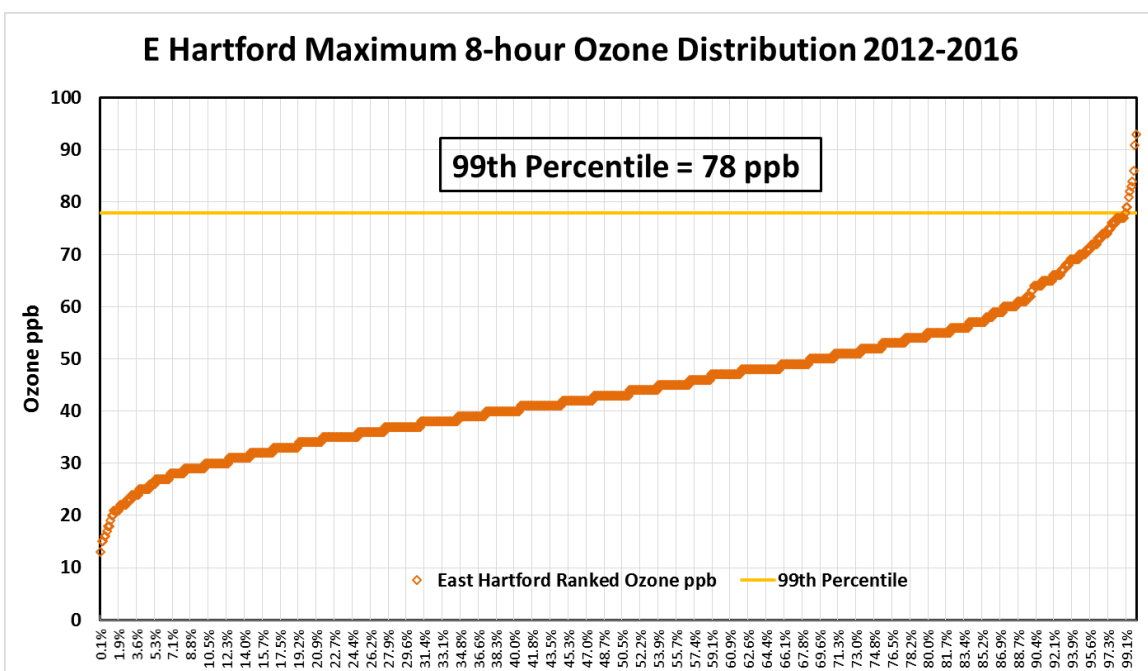


Figure 24. Ranked 8-hour Ozone Distribution for E Hartford CT 2012-2016

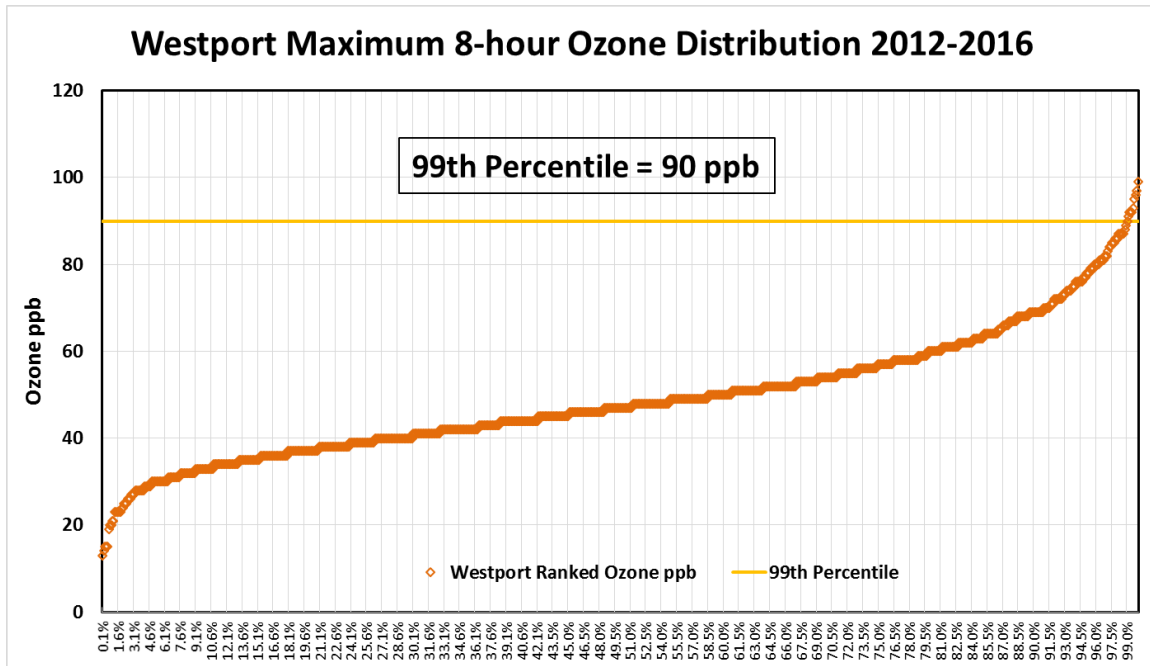


Figure 25. Ranked 8-hour Ozone Distribution for Westport CT 2012-2016

The following figures are the 5-year plots of the four monitors of interest in Connecticut. The 8-hour ozone concentrations for the May 25-26, 2016 event have been circled. To illustrate the frequency of high ozone days (i.e. > 70 ppb) with a northwest wind flow, we obtained sounding wind data from the nearest upwind site, Albany NY (ALY), for the 2010-2016 May-September time period. The mandatory sounding height of 925mb (~800m) was chosen, because it represents winds in the middle of the boundary layer and should be relatively free of surface drag effects. On May 25th 2016, the 925 mb wind direction at ALY was from 305° at 32 knots. We selected a wind direction (WD) compass range between 295°-335° to filter the days, because we wanted to include May 26th, when the wind direction had shifted to 295°. This range was broad enough to ensure that an ample number of days would be selected.

It is observed that most of the over 70 ppb days disappear over our Greater Connecticut monitors (Figures 26-29) when the filter is applied. At our Cornwall monitor, nearly all of the high ozone days are eliminated on days when the 925 mb wind is from this northwest direction. Not surprisingly, our coastal Westport monitor still displays numerous days above 70 ppb when applying this filter. This will be discussed in more detail later, but suffice to say that the sea breeze effect plays an important role in ozone transport to our coastal monitors, and this effect is frequently observed when the ozone levels are far below 70 ppb at our inland monitors. Another artifact that is observed on these charts is the abundance of high ozone days during 2012. This was due to multiple smoke events for that summer that likely had an influence on ozone concentrations in Connecticut.

Cornwall Connecticut

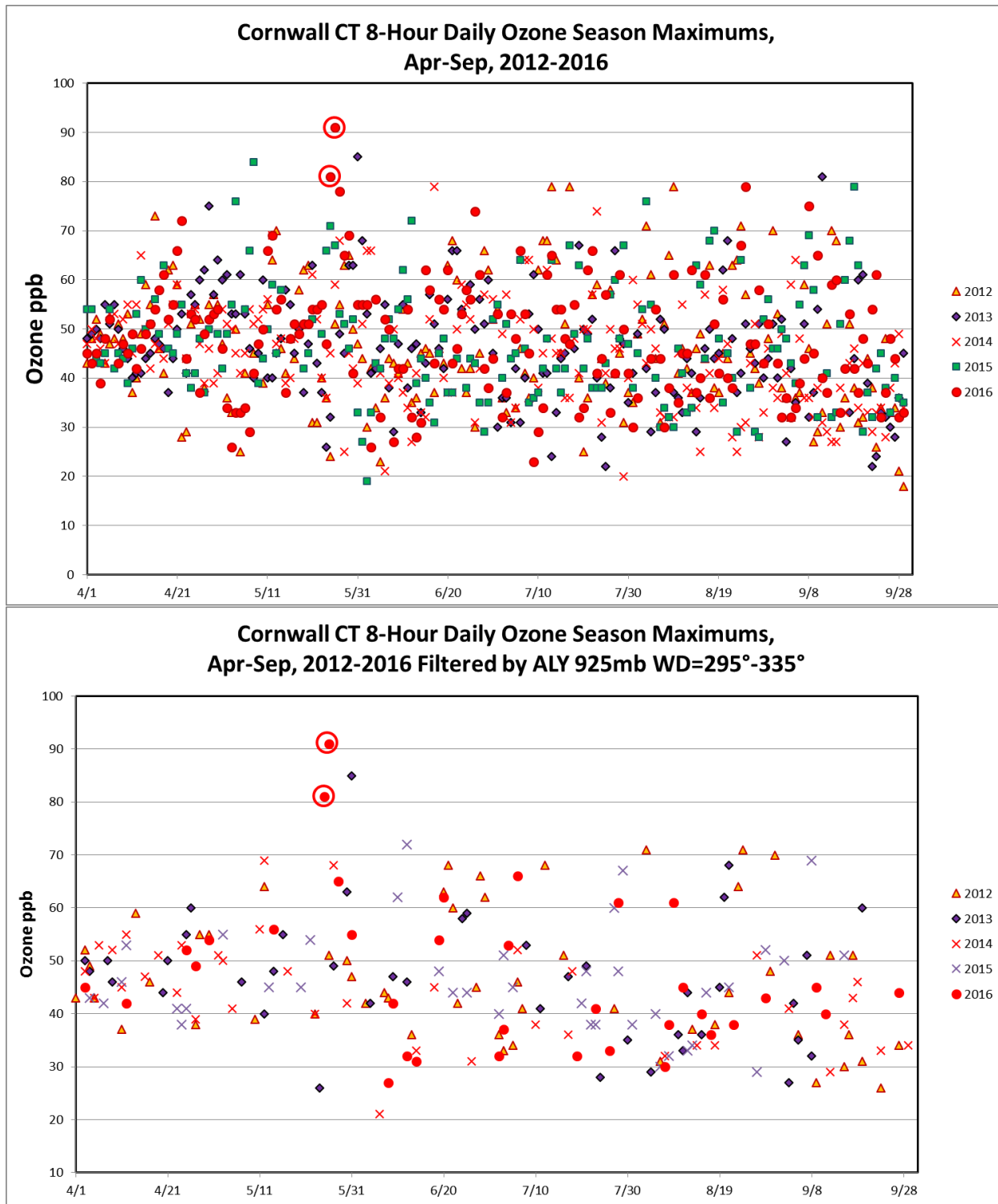


Figure 26. Cornwall CT Daily Ozone Season Maximums 2012-2016

East Hartford Connecticut

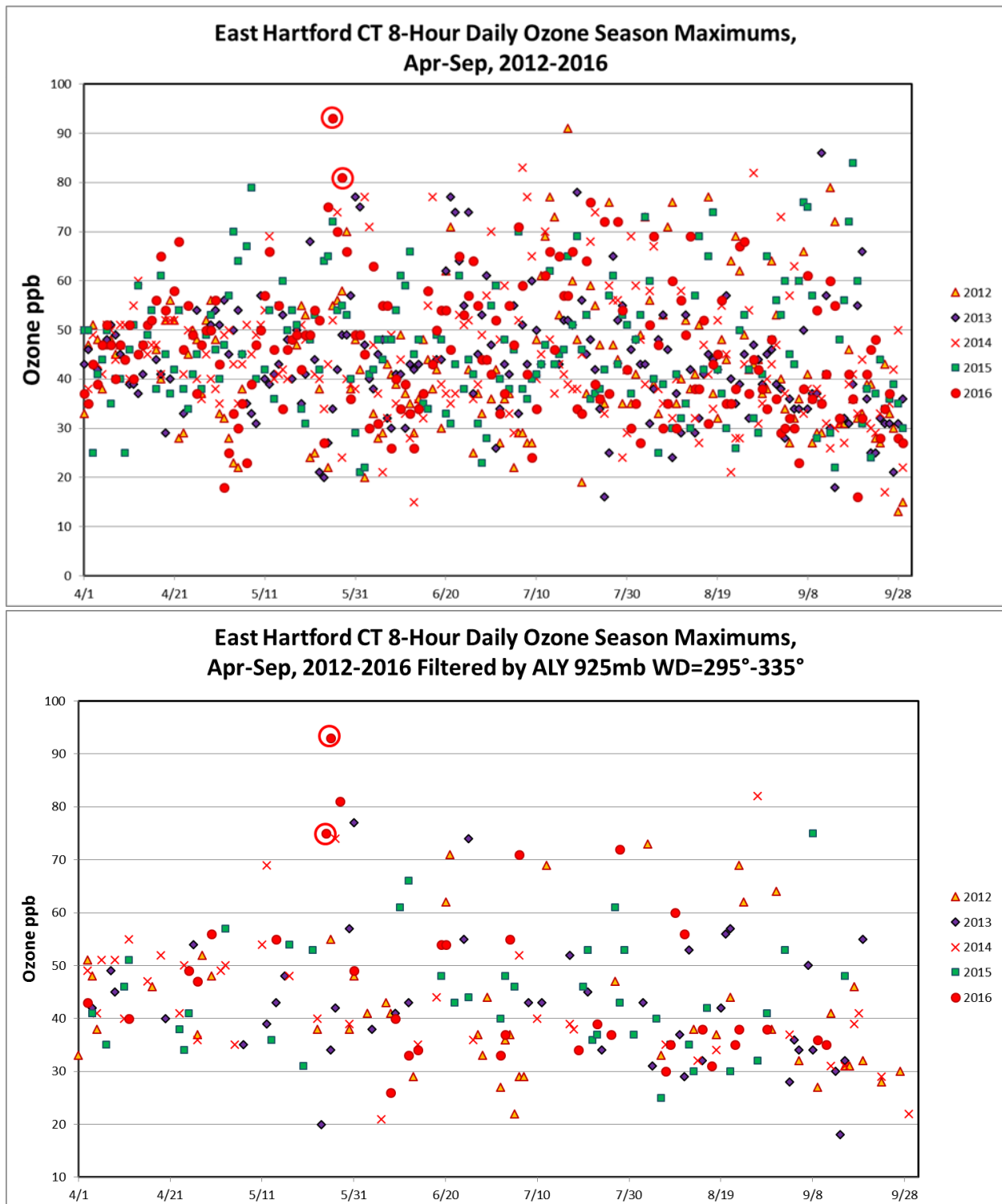


Figure 27. East Hartford CT Daily Ozone Season Maximums 2012-2016

Abington Connecticut

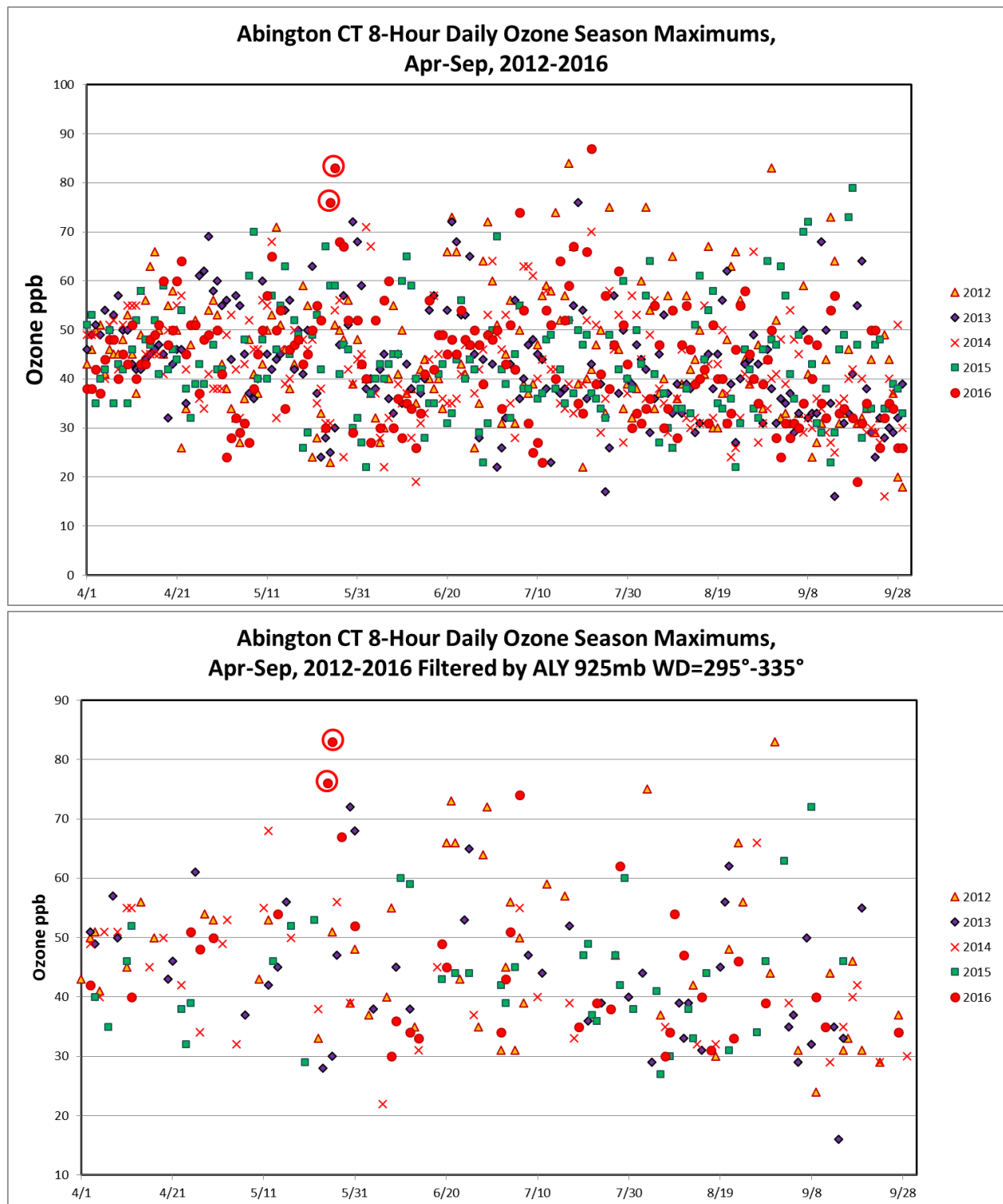


Figure 28. Abington CT Daily Ozone Season Maximums 2012-2016

Westport Connecticut

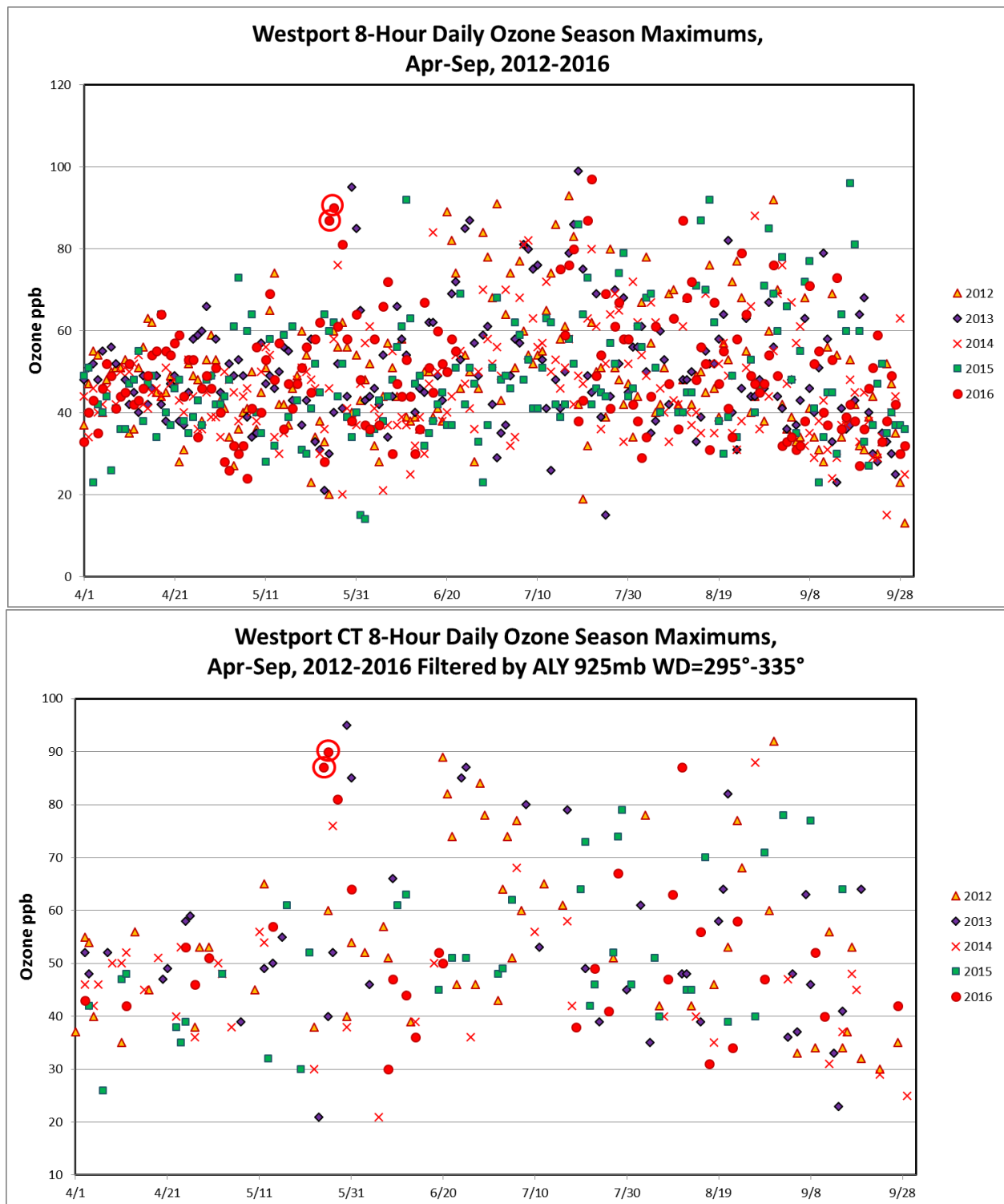


Figure 29. Westport CT Daily Ozone Season Maximums 2012-2016

Connecticut Hill New York

Sites to our west, especially in New York State, showed more of an outlier status on May 25th, 2016. The following chart (Figure 30) shows daily 8-hour maximum monitored ozone for the years of 2011-2016 at the Connecticut Hill monitor in New York. The 77 ppb 8-hour maximum ozone noted for May 25th, 2016, was the highest ozone reported during those 6 years.

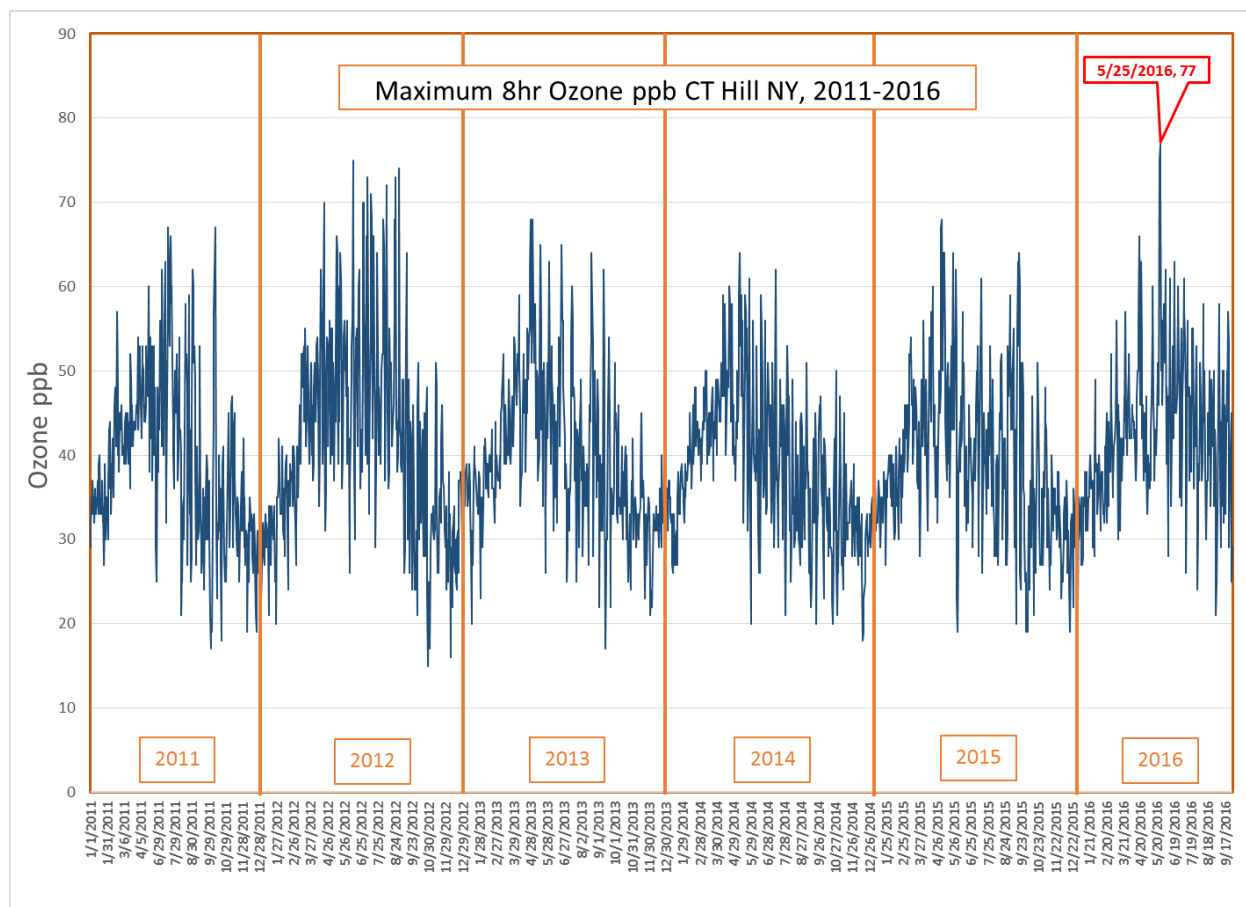


Figure 30. Monitored Daily Maximum 8-hour Ozone for 2011-2016 at Connecticut Hill, NY

Upwind Chemical Speciation Network (CSN) Sites

The U.S. EPA initiated the national PM_{2.5} Chemical Speciation Monitoring Network (CSN) in 2000 to support evaluation of long-term trends and to better quantify source impacts of particulate matter (PM) in the size range below 2.5 μm aerodynamic diameter (PM_{2.5}; fine particles). EPA also administers the long standing Interagency Monitoring of Protected Visual Environments (IMPROVE) visibility monitoring network in rural Class 1 Areas across the country. Both networks measure the major chemical components of PM_{2.5} using historically accepted filter-based methods.

Target Species:

- PM2.5 Mass by gravimetry,
- Elements (Al to Pb by X-ray fluorescence),
- Anions (nitrate and sulfate by ion chromatography),
- Cations (ammonium, sodium, and potassium by ion chromatography), and
- Organic Carbon (OC) and Elemental Carbon (EC)

Organic Carbon (OC) and Potassium (K) species are most closely associated with wildfire emissions, so we have selected the sites in Figure 31 to plot this data against the monitored 8-hour ozone maximums for these days. Samples were collected every three or six days at these sites. The plots generally show that K and/or K⁺ and OC showed upward trends when the ozone levels were elevated, especially on May 24th, 2016. This concurs with the presence of a smoke plume over the area on that day. Figures 32-38 show these plots, and we included Seney, Michigan, since it is an IMPROVE wilderness background site.

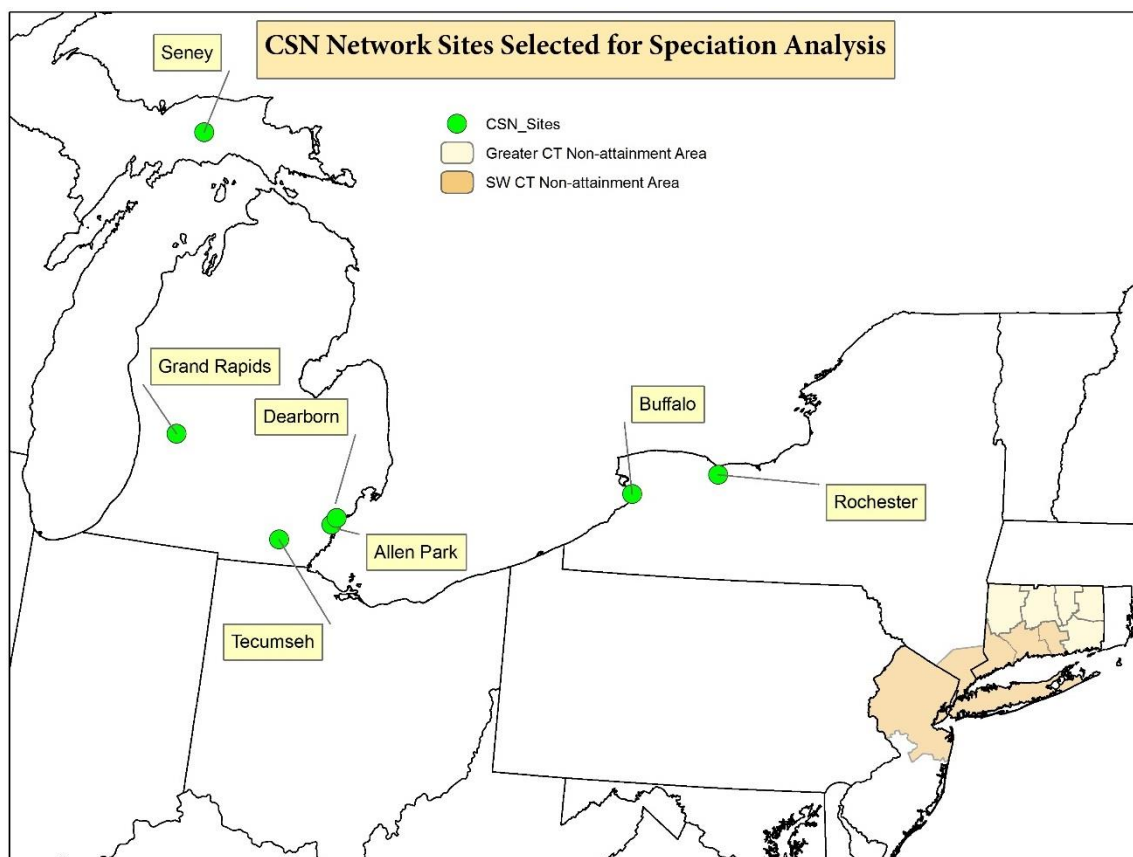


Figure 31. CSN Sites Selected for Speciation Analysis

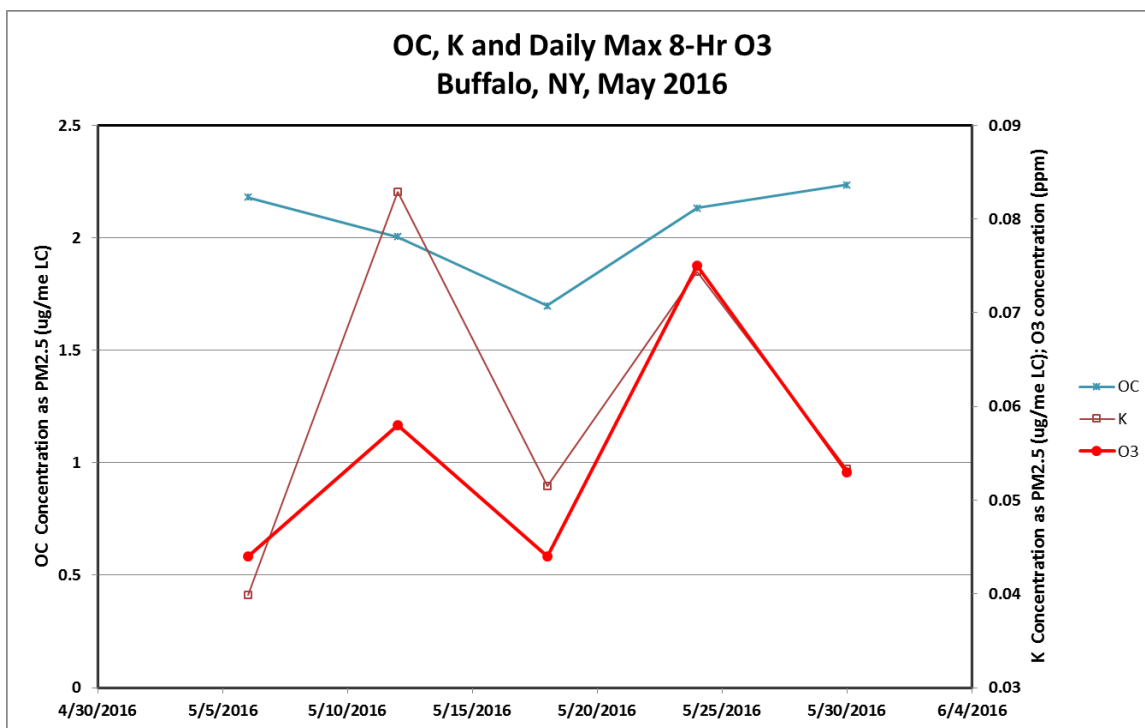


Figure 32. Buffalo New York CSN Data

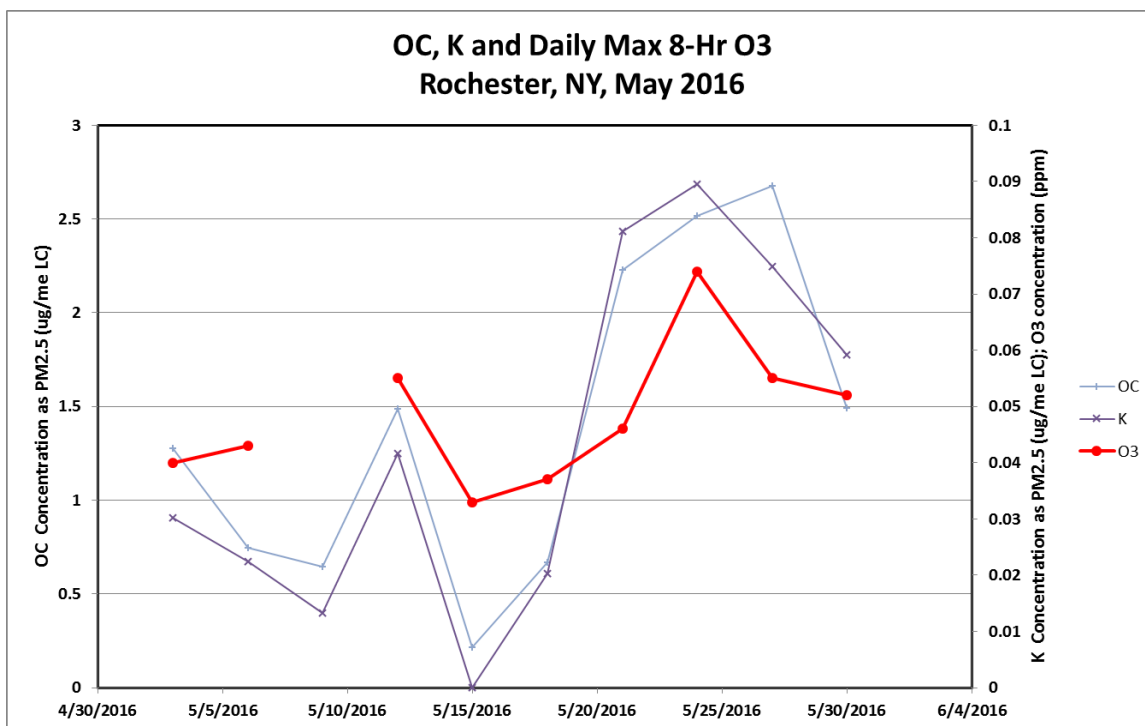


Figure 33. Rochester New York CSN Data

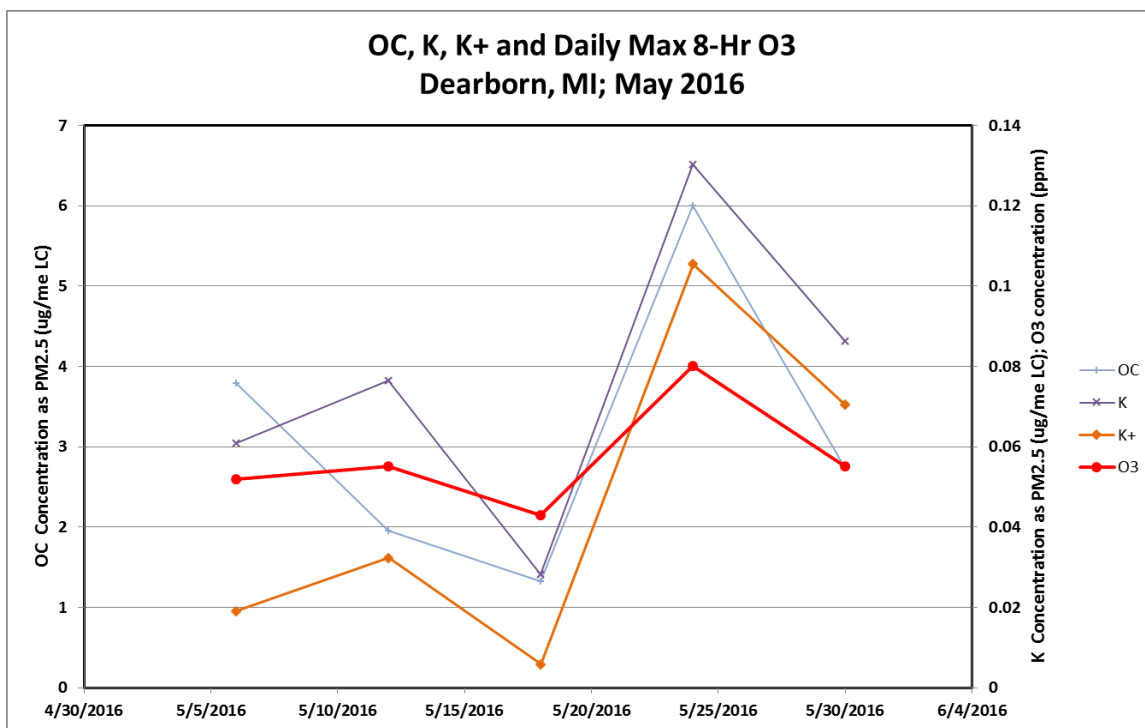


Figure 34. Dearborn Michigan CSN Data

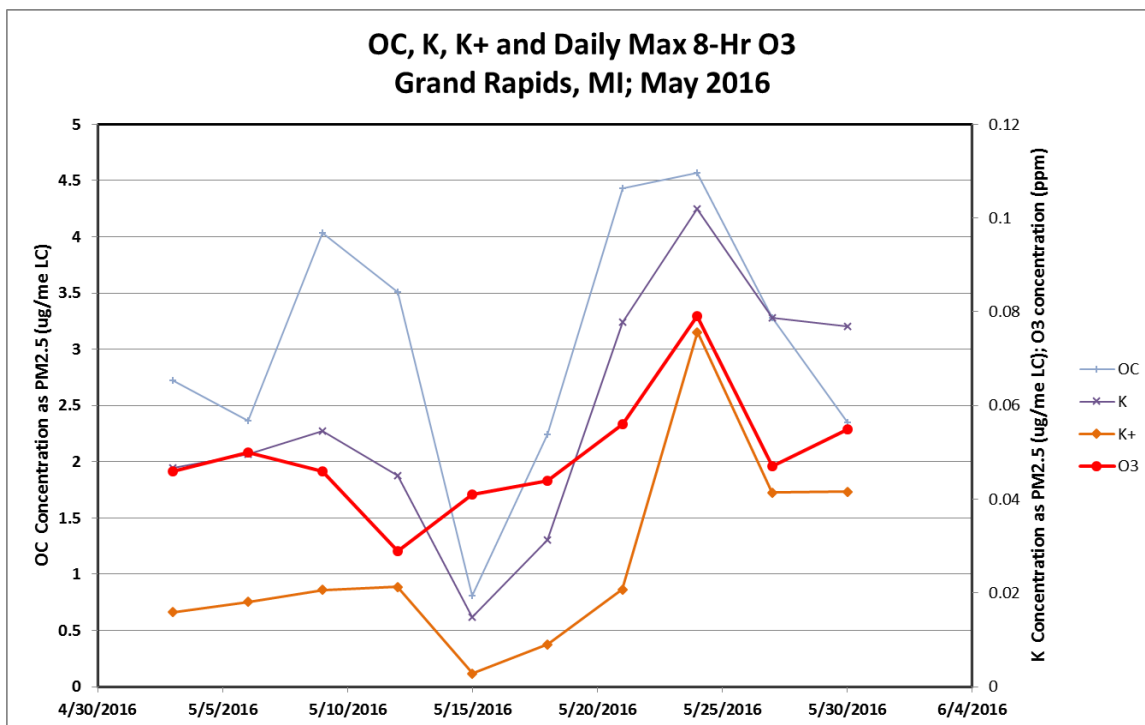


Figure 35. Grand Rapids Michigan CSN Data

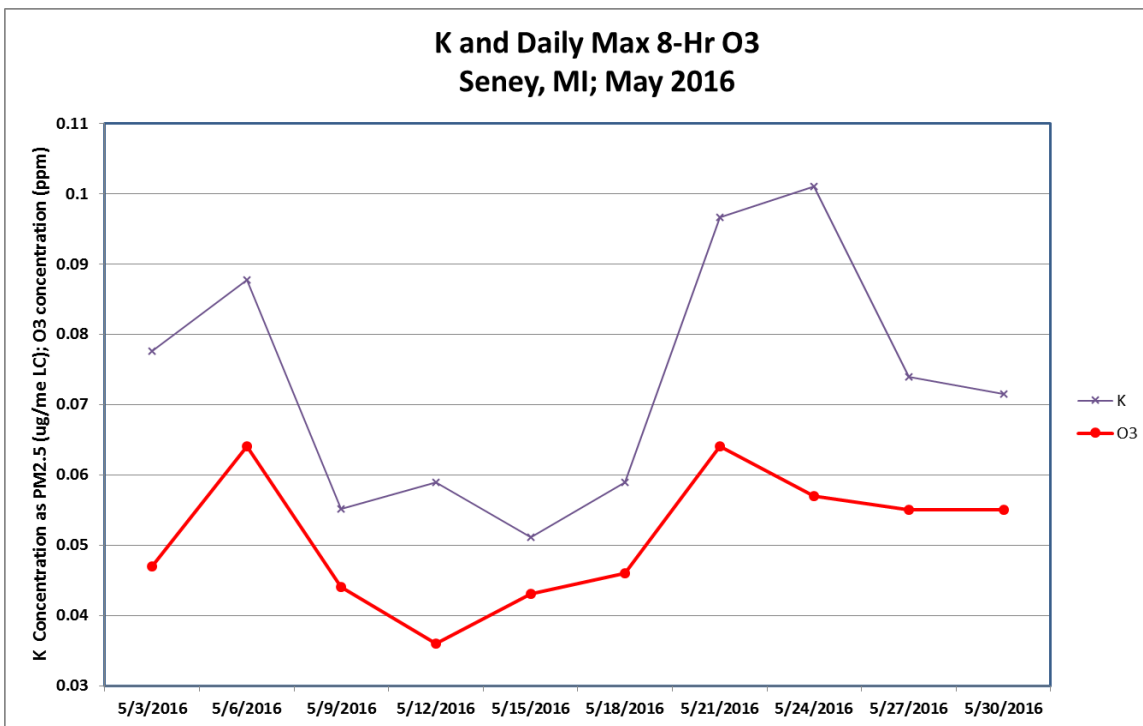


Figure 36. Seney Michigan IMPROVE Data

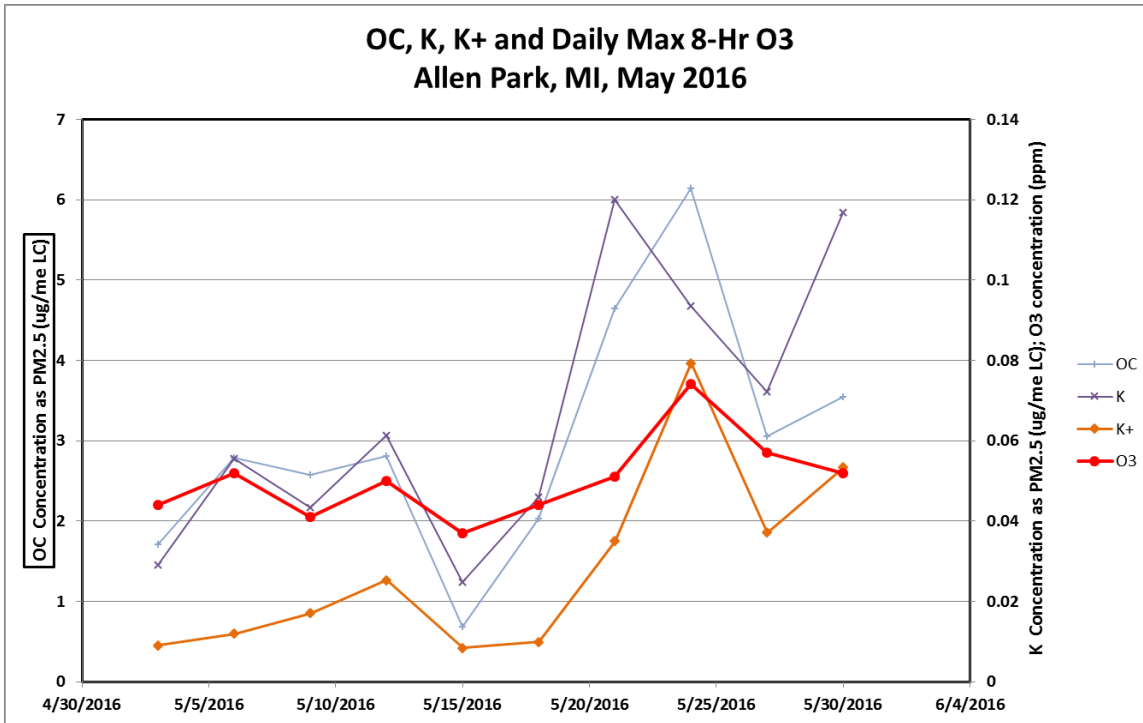


Figure 37. Allen Park Michigan CSN Data

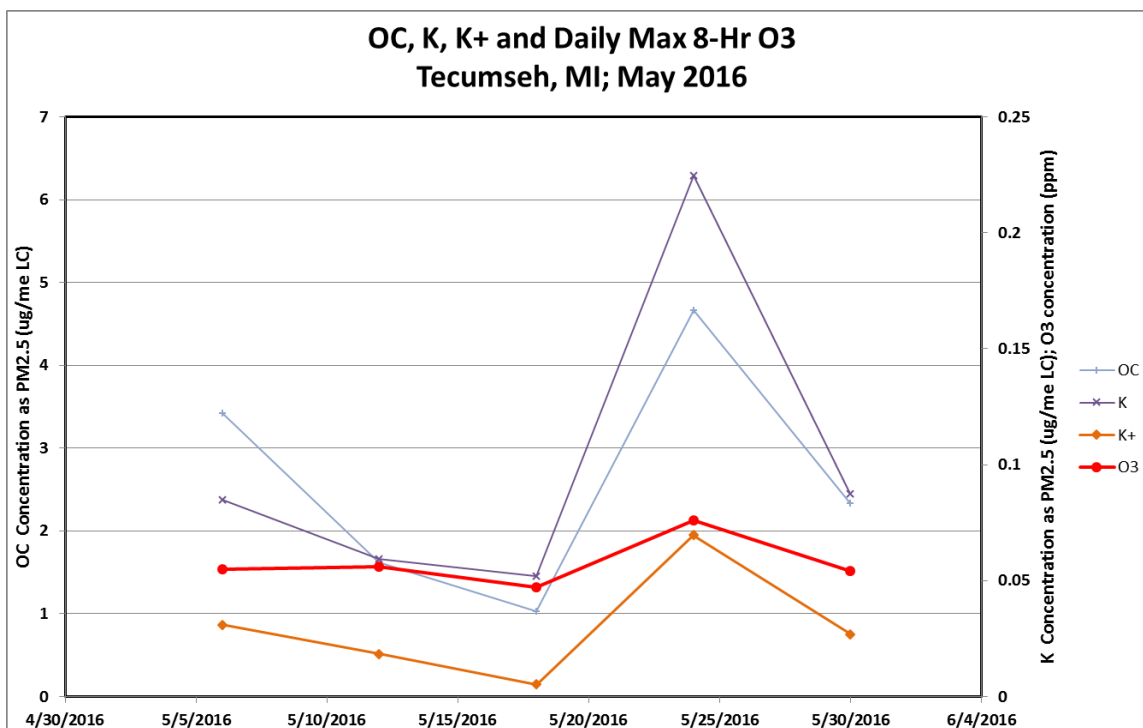


Figure 38. Tecumseh Michigan CSN Data

3.3 Similar Day Analysis

According to the EE Guidance: “*Comparison of O₃ Concentrations on Meteorologically Similar Days (Matching Day Analysis). O₃ formation and transport are highly dependent upon meteorology. Therefore, a comparison between O₃ on meteorologically similar days with and without fire impacts could support a clear causal relationship between the fire and the monitored concentration. Both O₃ concentrations and diurnal behaviors on days with similar meteorological conditions can be useful to compare with days believed to have been influenced by fire. Since similar meteorological days are likely to have similar O₃ concentrations, significant differences in O₃ concentrations among days with similar meteorology may indicate influences from non-typical sources.*”

Methodology

Simply using surface winds and/or temperatures at our Connecticut monitors as a predictor for ozone can be problematic because of the land/sea interface. Inland ozone monitoring sites can observe northwest winds and very warm temperatures while the coastal sites will experience a southwest sea breeze and much cooler temperatures. Historically, it used to be the case at temperatures over 90 ° F would be a good indicator for ozone production, but with NO_x emissions on the decline, one must look at other factors.

For example, the highest temperature recorded at Bradley Airport occurred on July 6, 2010, when it reached 102° F. Figure 39 shows that there was a northwest wind flow for most of the State, except for the immediate coast. Back trajectory analysis did not have sufficient spatial resolution to show that there was southwest surface wind transport from the New York City area to the Connecticut coast, aided by the sea-breeze, where an ozone exceedance occurred. This is a good example that shows that high surface temperatures are not always correlated with high ozone concentrations. The path of the source air to the monitor is often the better indicator for whether there will be elevated ozone on that day, and not just the surface wind direction.

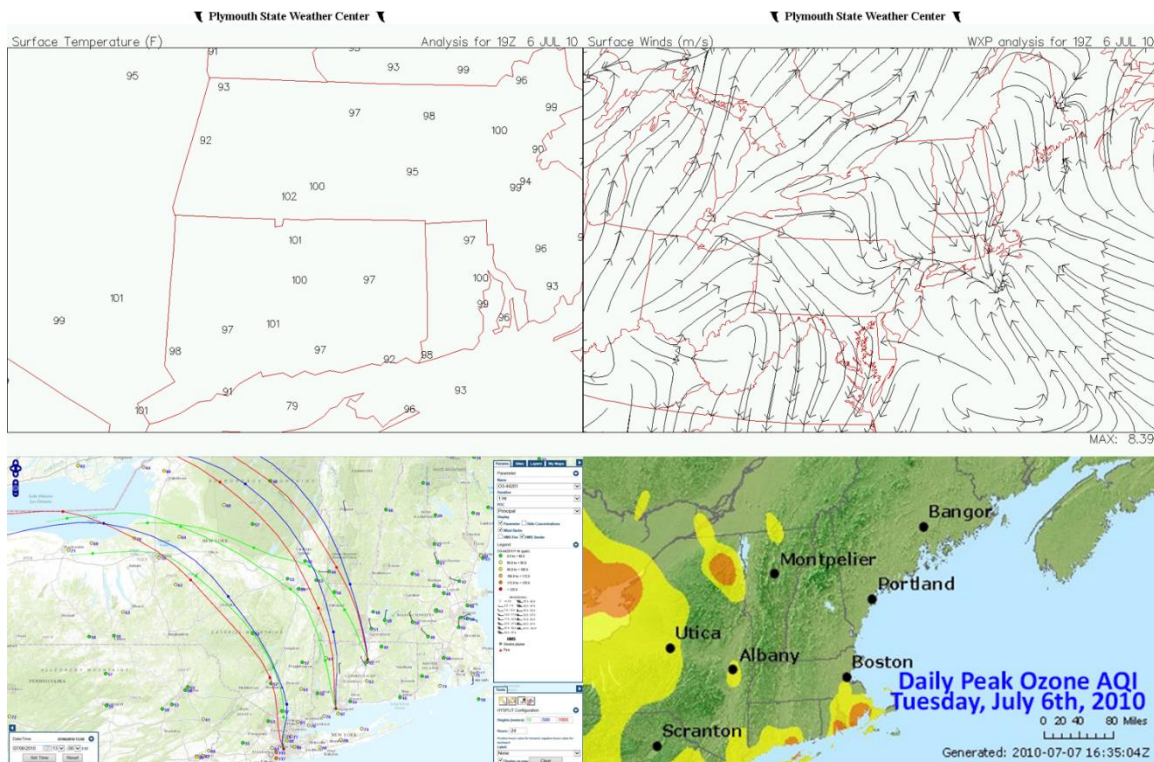


Figure 39. Temperatures and Winds around Connecticut on July 6, 2010

A more reliable variable for identifying similar days from past years is to look for similar 850mb pressure and wind patterns. The following method was used for this analysis:

- 12z sounding data from Albany (ALY) was analyzed from May 25th, 2016 to determine 850 mb winds;
- Obtained all ALY sounding data from May- September 2012-2016;
- Filtered wind direction for 310-330 degrees and greater than or equal to 20 knots;
- Ran 24 hour HYSPLIT back trajectories from 16z (noon) for those days that fit this criteria;
- Chose several days from each year that most closely matched 500m/1500m back-trajectories to Lake Huron region.
- Plotted 850 mb North American Regional Reanalysis (NARR) maps (if available) for those dates, to examine similarity of pressure height patterns.

It was determined that the 850mb from ALY was from 320 degrees at 23 knots from the 12z sounding. Figure 40 is a graphic of the 12z sounding from that day. It shows northwest wind flow from all levels above the surface.

An 850 mb height map (Figure 41) was generated from that day to create a reference pattern for comparison. An 850 mb ridgeline extended north to just west of Hudson's Bay in Canada. Source winds to Connecticut would be expected to originate in eastern Canada, which is generally air that is low in ozone precursors, barring any wildfires in the region. Figure 42 are the HYSPLIT trajectories for that day that show the 500 and 1500 meter back trajectories originating near lake Huron. Figures 43-47 represent closely matching 850 mb examples from 2012-2016 with the accompanying AQI maps for those days. In every one of those cases, the ozone levels were in the good to moderate range.

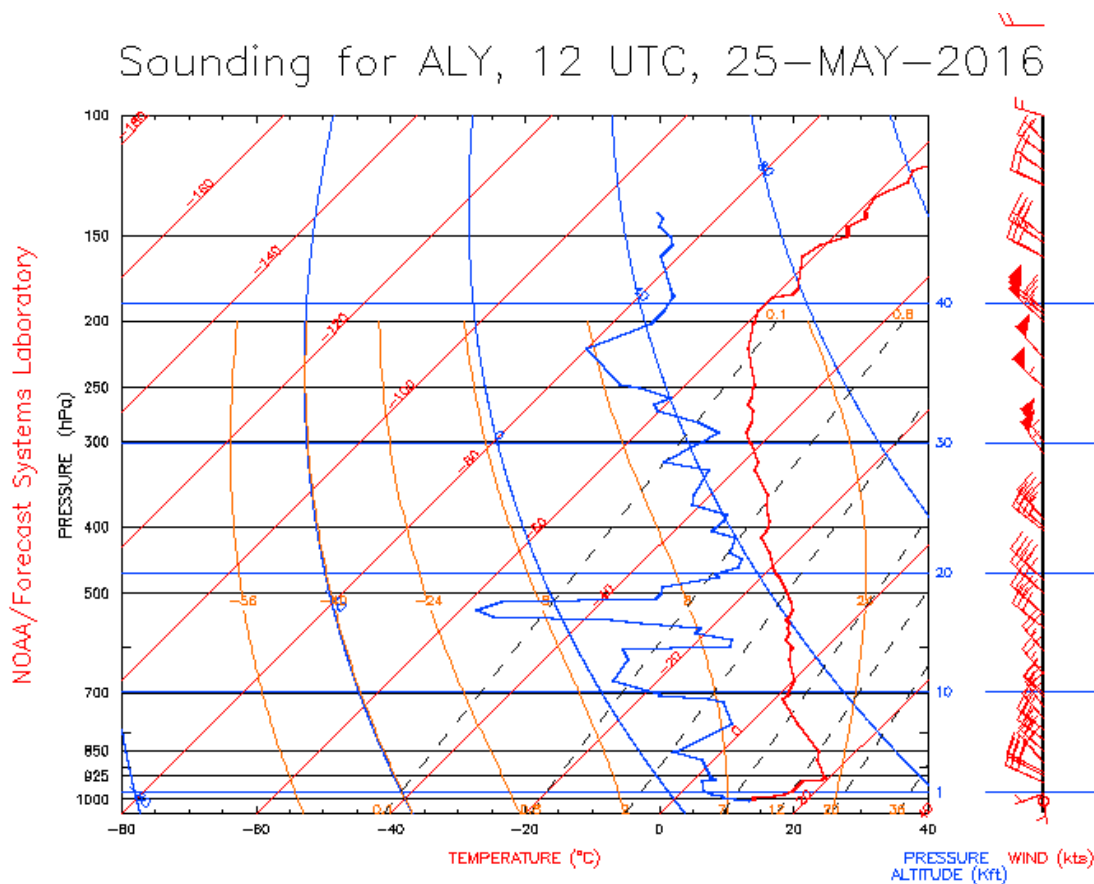


Figure 40. 12z ALY Sounding from May 25th, 2016

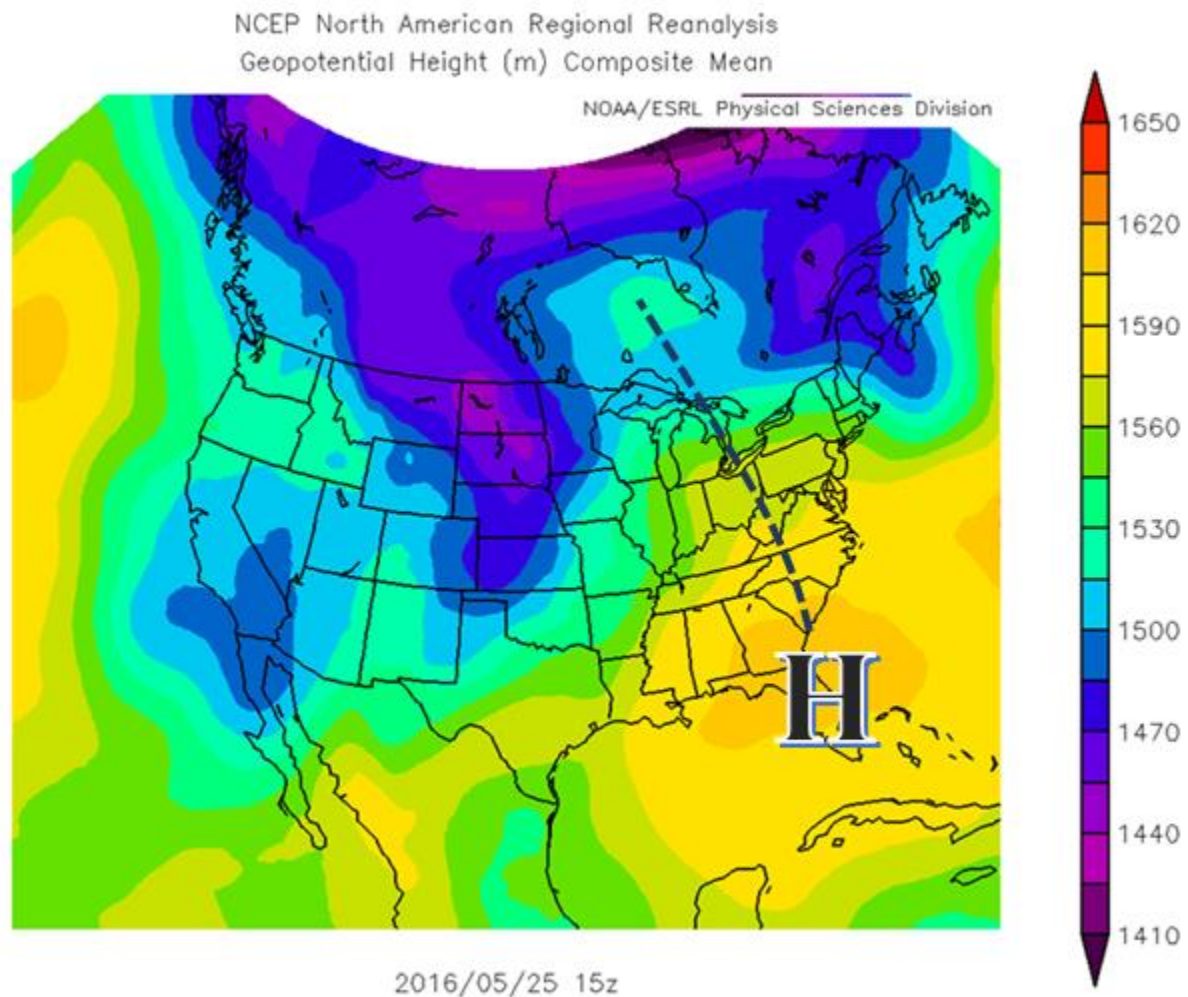


Figure 41. 850 mb Reference Pressure Pattern for May 25th, 2016

NOAA HYSPLIT MODEL
Backward trajectories ending at 1600 UTC 25 May 16
NAM Meteorological Data

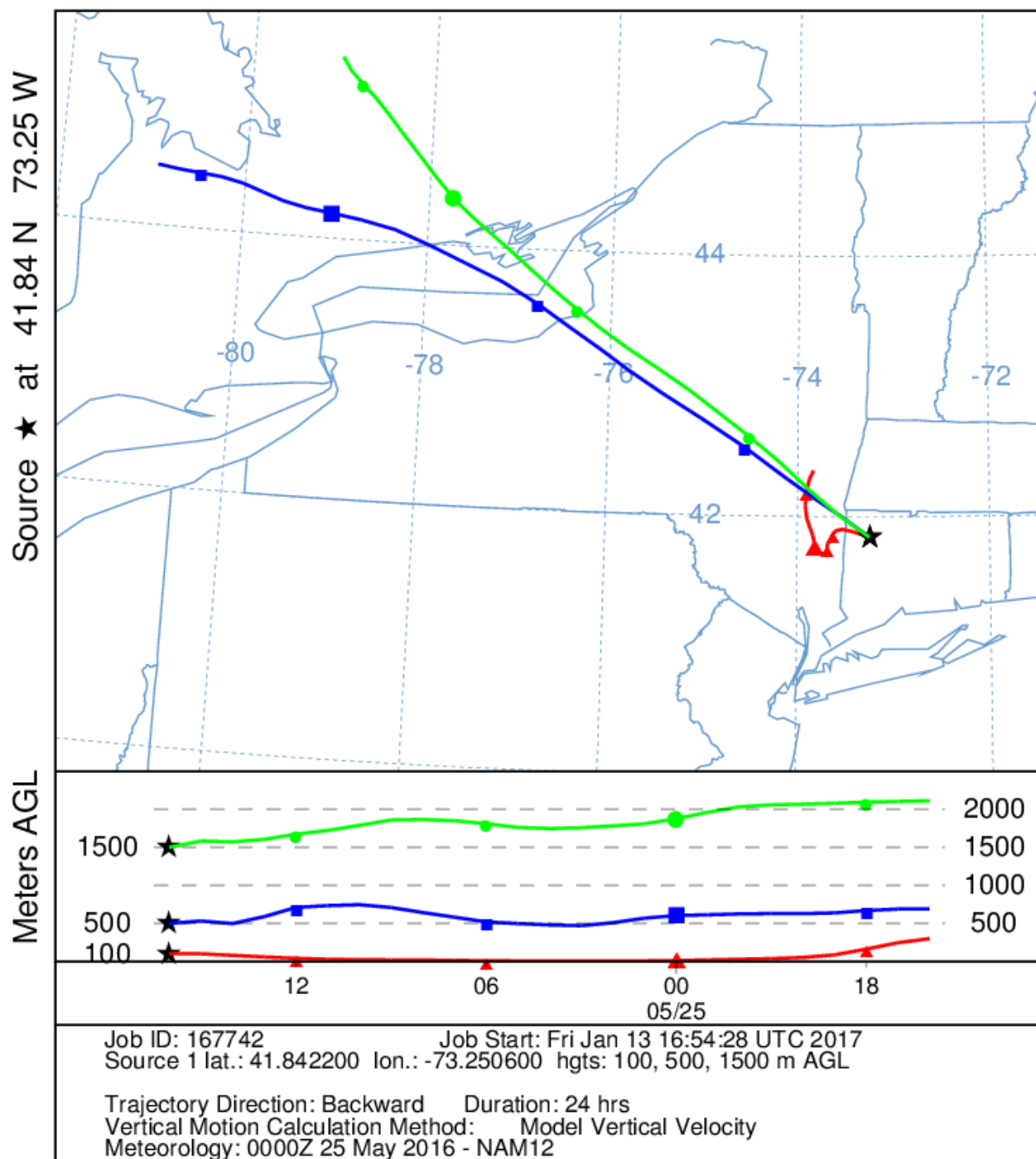


Figure 42. HYSPLIT Reference Trajectories from May 25th, 2016

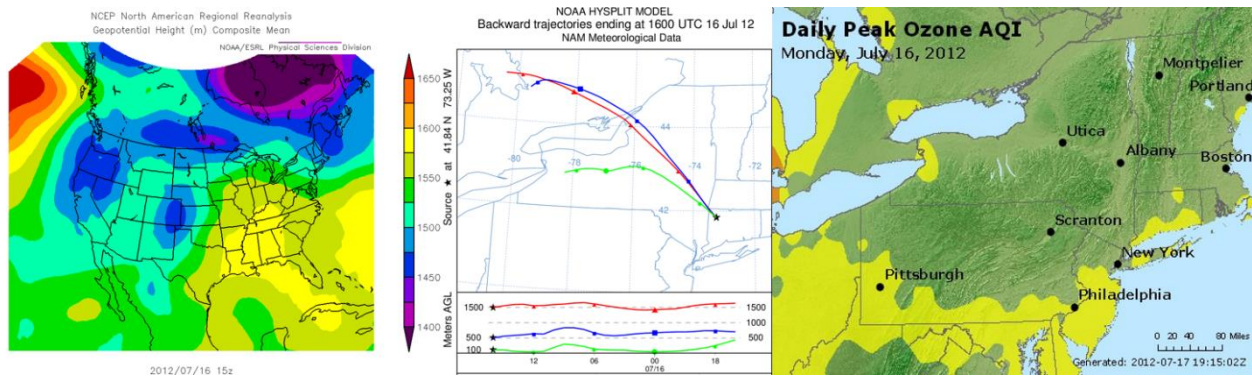


Figure 45. Matching 850 mb Pressure Pattern with Back Trajectories July 16, 2012

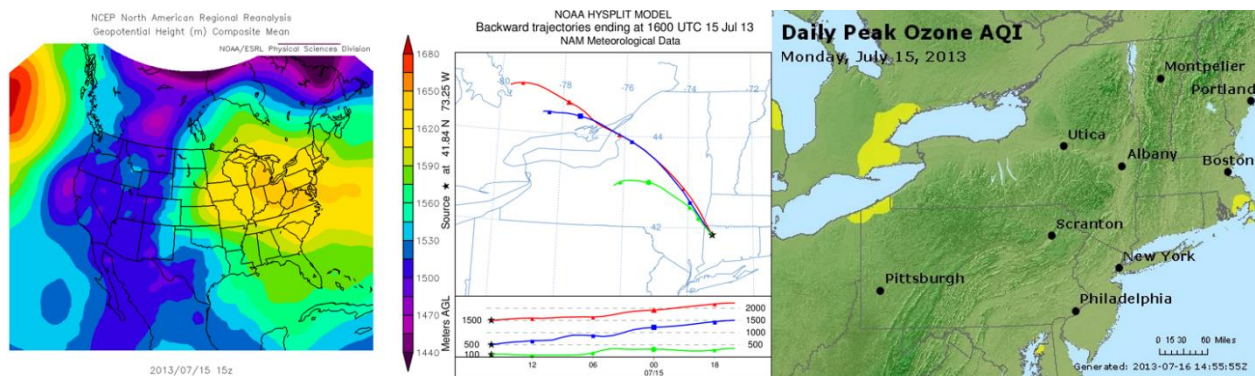


Figure 44. Matching 850 mb Pressure Pattern with Back Trajectories July 15, 2013

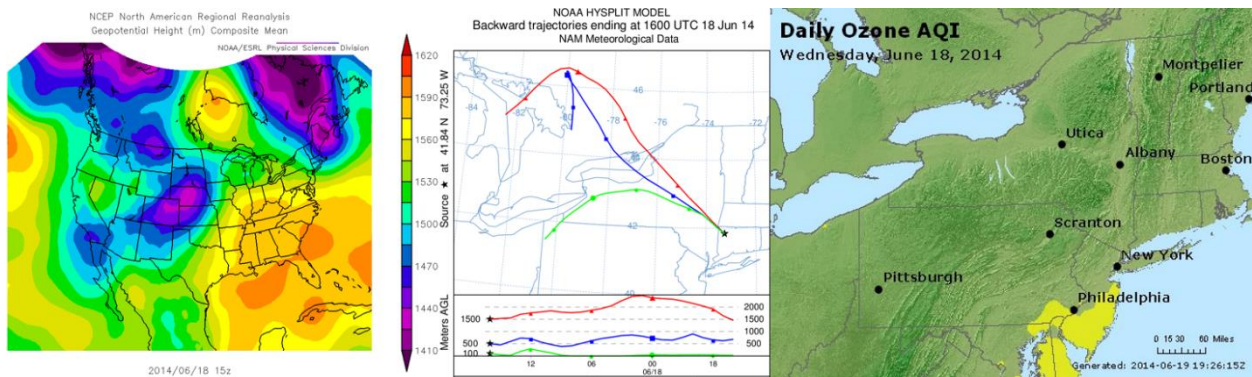


Figure 43. Matching 850 mb Pressure Pattern with Back Trajectories June 18, 2014

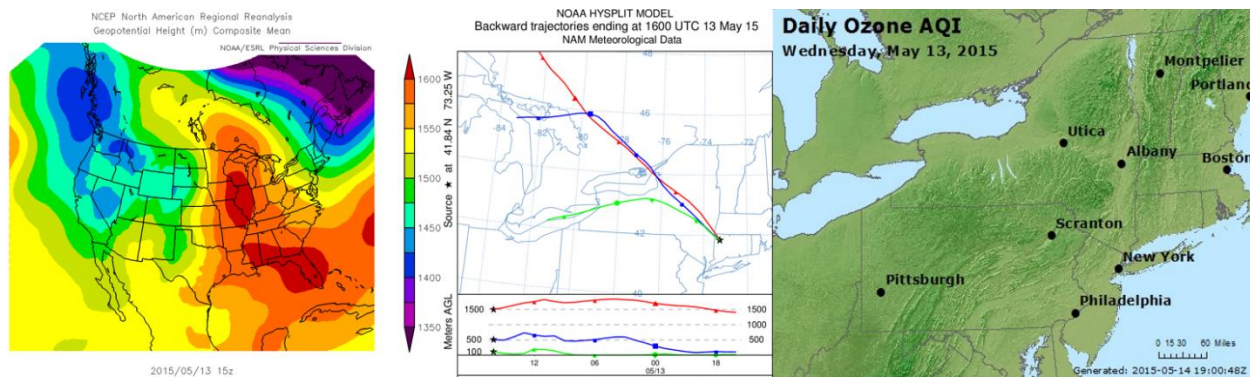


Figure 46. Matching 850 mb Pressure Pattern with Back Trajectories May 13, 2015

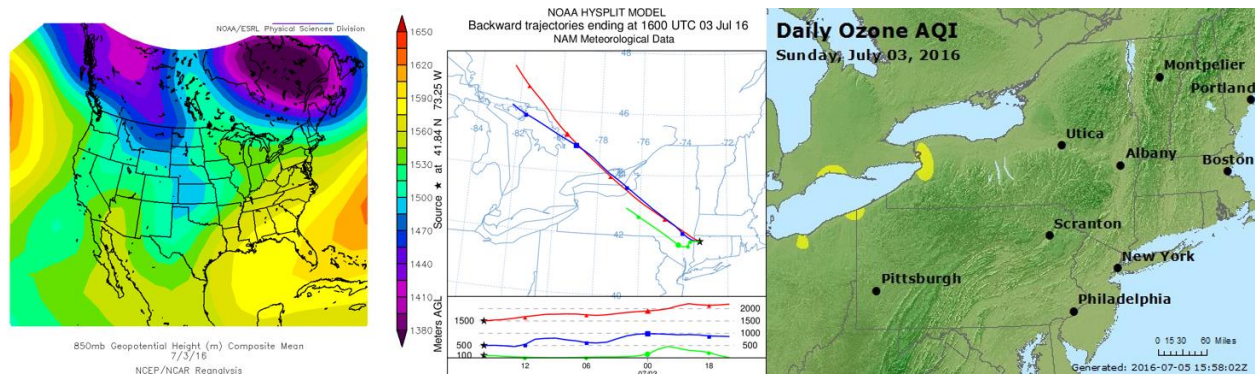


Figure 47. Matching 850 mb Pressure Pattern with Back Trajectories July 3, 2016

3.4 HYSPLIT Trajectory Analysis

According to the guidance: “Air agencies can produce HYSPLIT trajectories for various combinations of time, locations and plume rise. HYSPLIT back-trajectories generated for specific monitor locations for days of high O₃ concentrations illustrate the potential source region for the air parcel that affected the monitor on the day of the high concentration and provide a useful tool for identifying meteorological patterns associated with monitored exceedances. Forward-trajectories from specific wildfire events to specific monitors can also be used to indicate potential receptors.”

Forward Trajectory Example

Although the actual ozone event over Connecticut occurred after May 24th, 2016, the conditions producing the ozone were taking place several days before, over the Mid-western States. The model of choice was the North American Regional Reanalysis (NARR) model, which uses the

very high resolution NCEP Eta Model (32km/45 layer), together with the Regional Data Assimilation System (RDAS) which, significantly, assimilates precipitation along with other variables. The 120-hour May 18th forward trajectory was chosen as a scenario where particles and VOCs released at 1000-2000 meters above ground level could theoretically travel from the Fort McMurray, Alberta plume and pass over Michigan after May 21st (Figure 48). The VIIRS satellite image on May 18th shows the parts of the plume heading east over Hudson's Bay, on its way to Michigan a few days later (Figure 49). This is significant, since on May 21st, a high

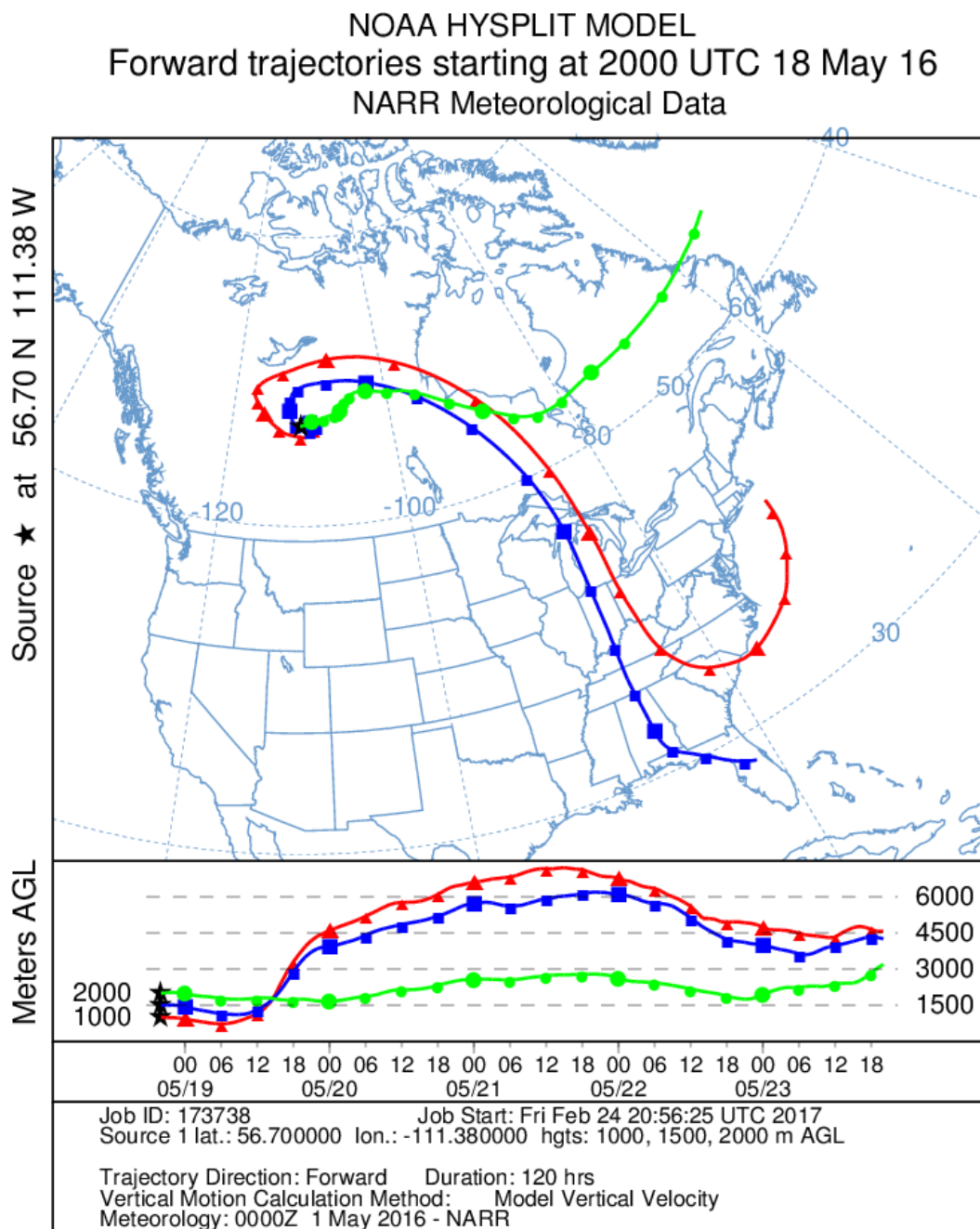


Figure 48. 120-hour HYSPLIT Forward Trajectories from Fort McMurray May 18-23, 2016

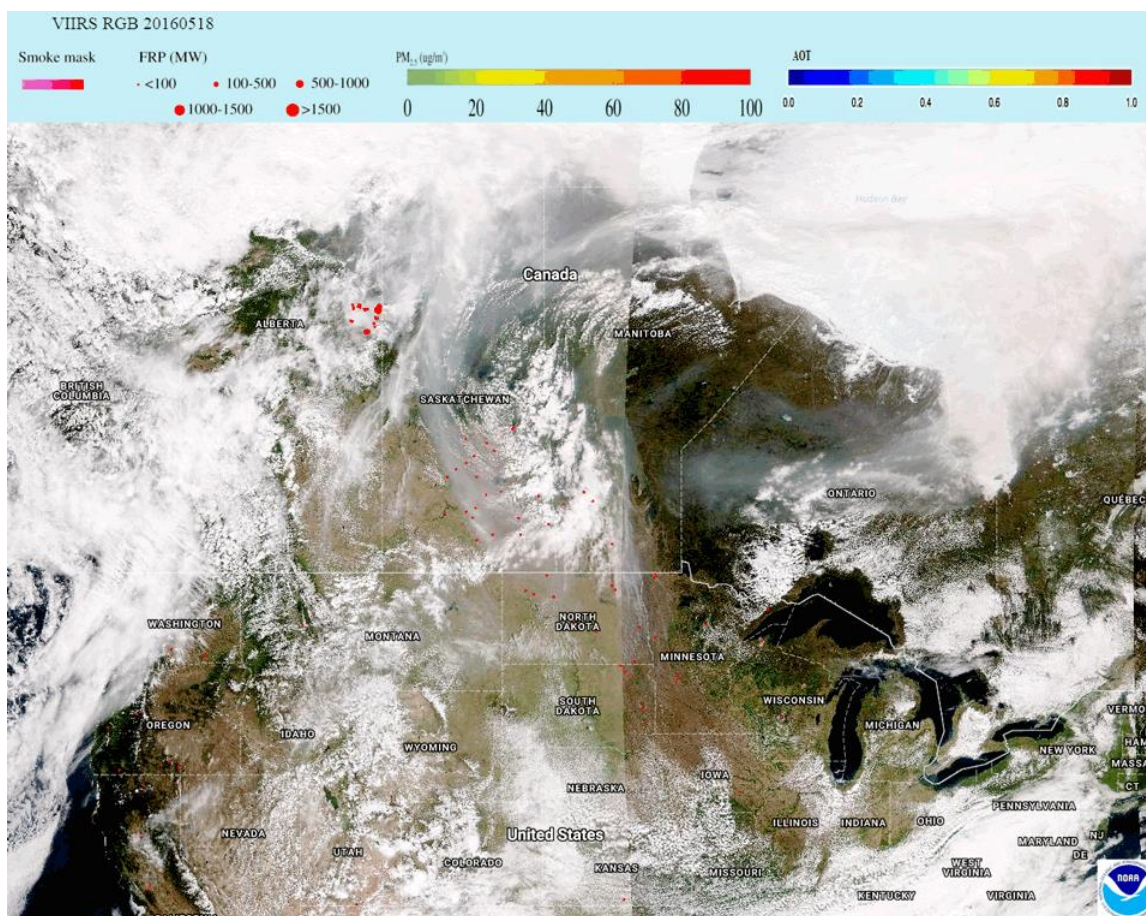


Figure 49. VIIRS Satellite Image from May 18, 2016

system was camped over the Mid-western States (Figure 50), which would trap the pollutants and later lead to the production of ozone over the Great Lakes' States.

Back Trajectory Analysis

Ozone began building up around the Great Lakes' on May 23rd and peaked on May 24th (Figure 51) before moving east to Connecticut. The forward trajectories and plume analysis clearly showed that the smoke plume settled over this area for several days. Back trajectory analysis for this area confirms the source of the ozone precursors (Figure 52). By May 24th, the wind had turned to the southwest, which allowed the VOC's from the smoke to mix with the Urban NO_x sources to the south and rapidly produce ozone on that day. Figure 53 shows a matrix of back trajectories ending at 1000m over western New England for both May 25th and May 26th. The source region is clearly the Michigan area on both days, but they shift southward on May 26th. The winds also turned southwestward over Long Island Sound (LIS) on May 26th, which provides some enhancement from the New York City area.

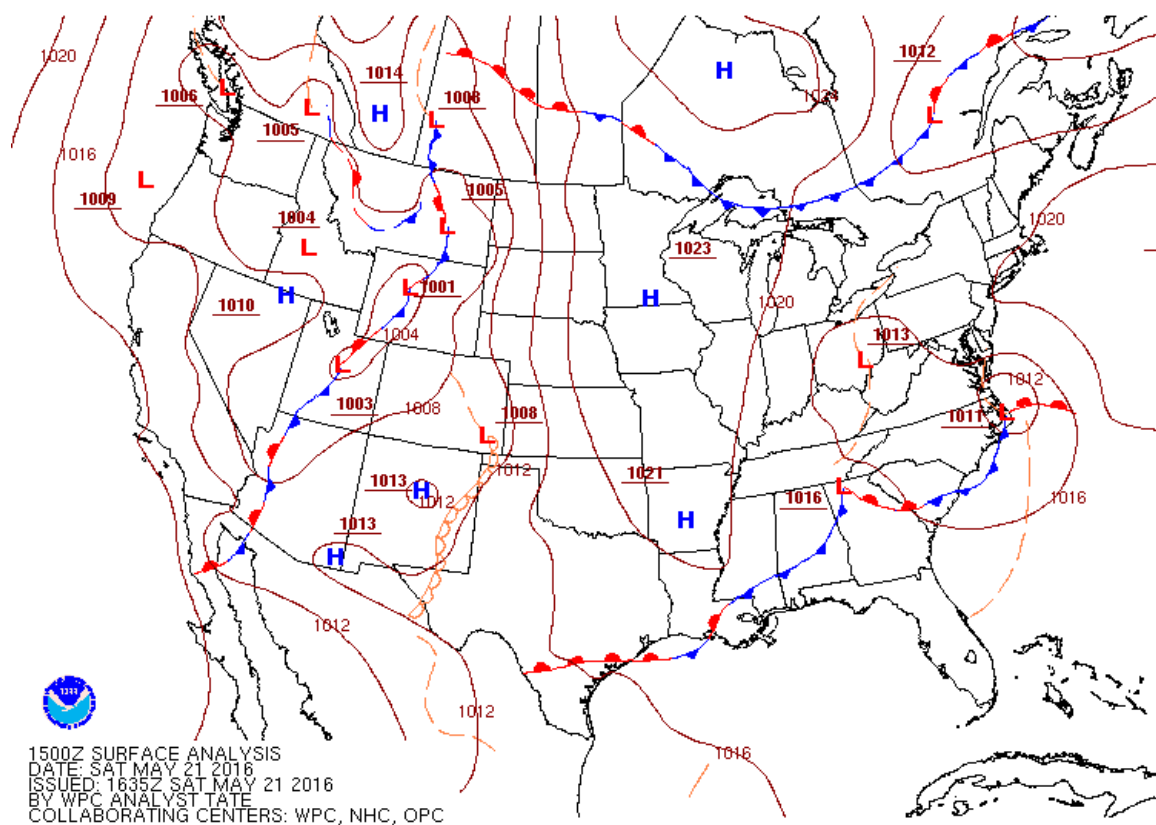


Figure 50. Surface Weather Analysis from May 21, 2016

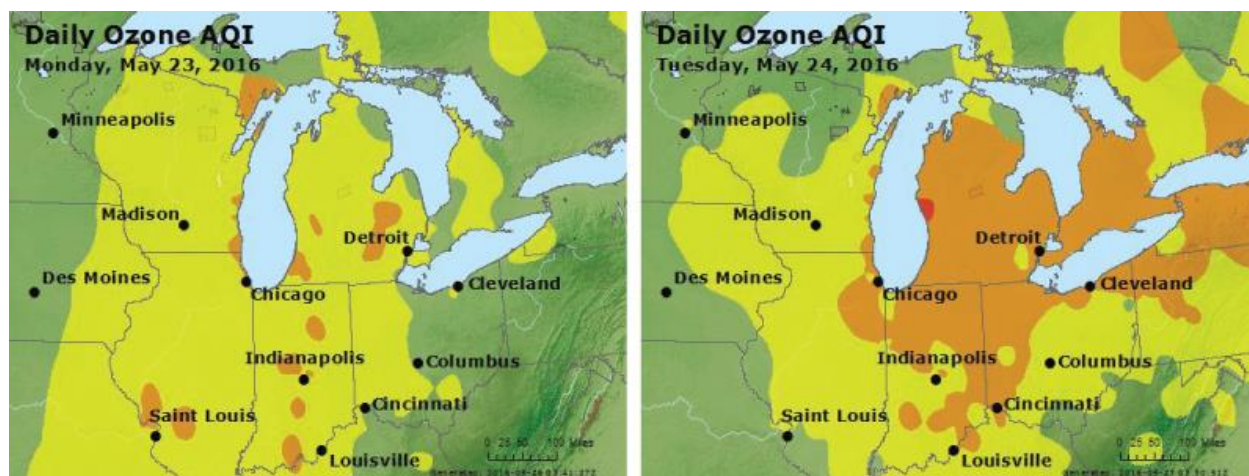


Figure 51. Ozone AQI Maps for May 23-24, 2016

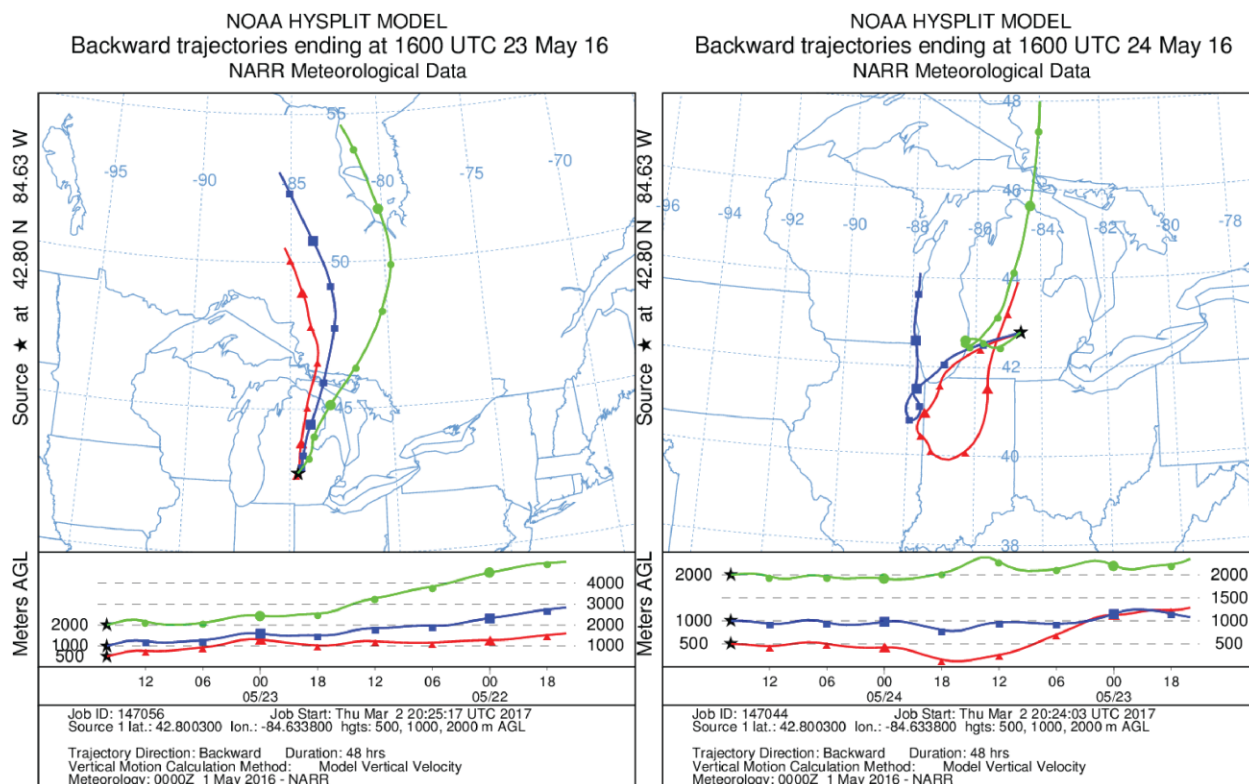


Figure 53. HYSPLIT Back Trajectories from Michigan, May 23- 24, 2016

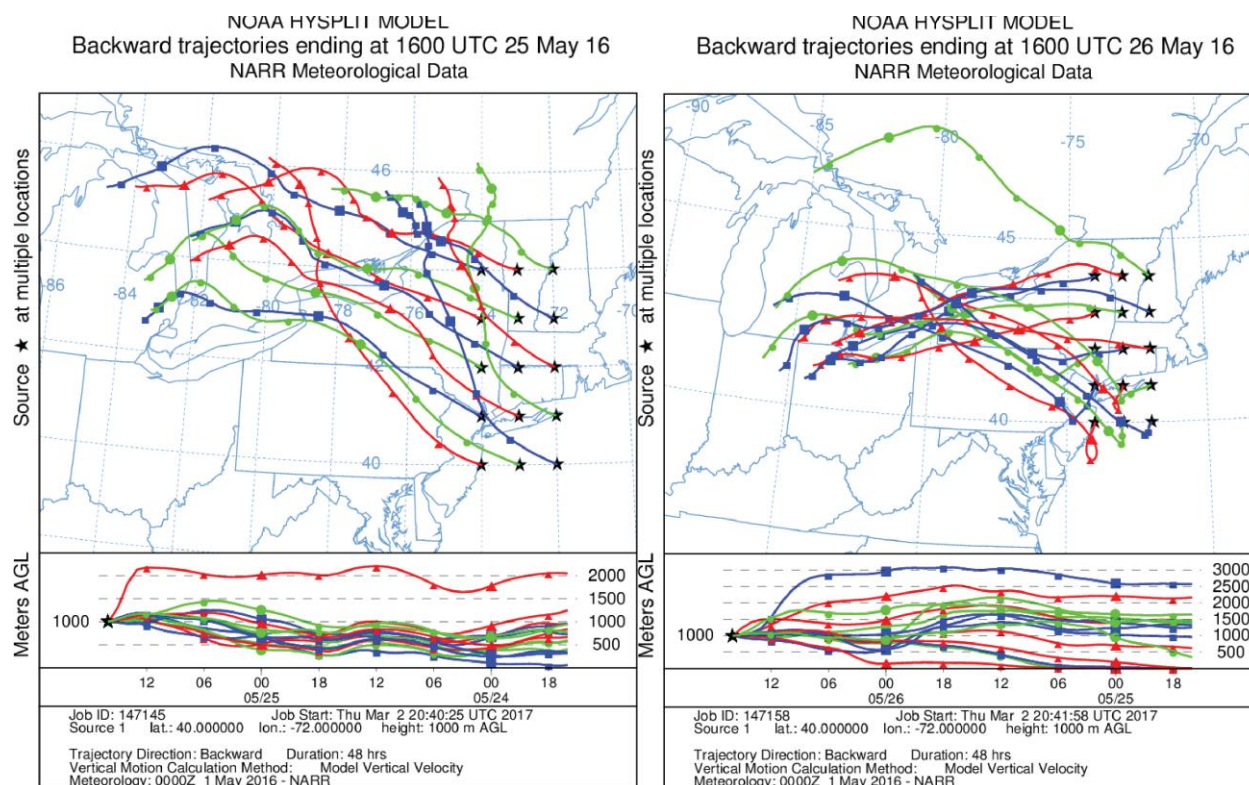


Figure 52. HYSPLIT Back Trajectories from New England

3.5 CSAPR NOx Source Emissions

Although point source EGUs have traditionally played a major role during ozone events on the East Coast, mobile source NOx emissions are becoming the major player as more EGUs adopt much needed controls. Nevertheless, it is still observed that during many summer events, more, and often dirtier, EGUs come online to fulfill the high electric demand days (HEDD). EPA monitors the real-time emissions from the CSAPR source facilities and the following figures (54-56) show the CSAPR 2016 daily NOx emissions for our closest upwind States; Pennsylvania, New York and New Jersey. Also plotted, on the right hand axis, are the number of Connecticut monitors that exceeded the 70 ppb NAAQS on that day. This gives a good indication of the extent of the ozone exceedances on any given day. Since the May 25-26th ozone event had the most monitored daily exceedances of the summer, it is worth noting that the NOx emission peaks that were recorded were well below the events later in the season. This lends credence to the weight of evidence that the wildfire plume was the major contributor to the ozone levels for those days.

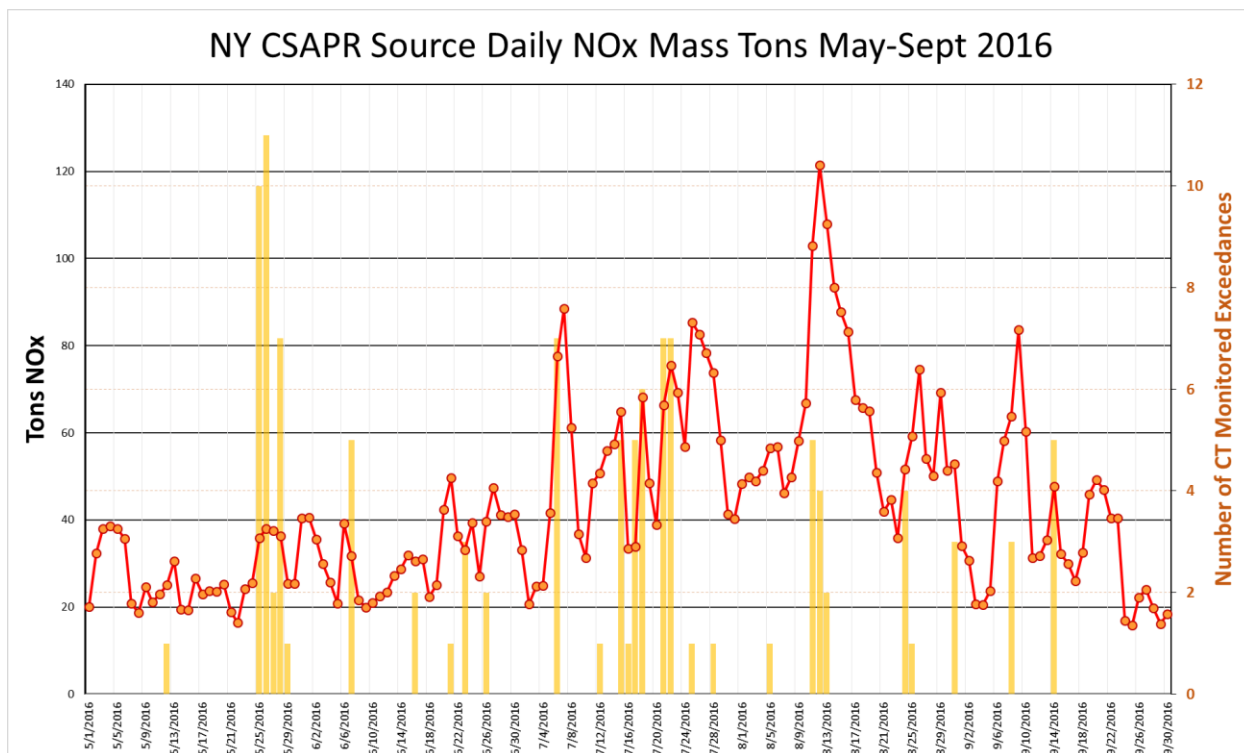


Figure 54. New York CSAPR Source 2016 Daily NO_x Emissions

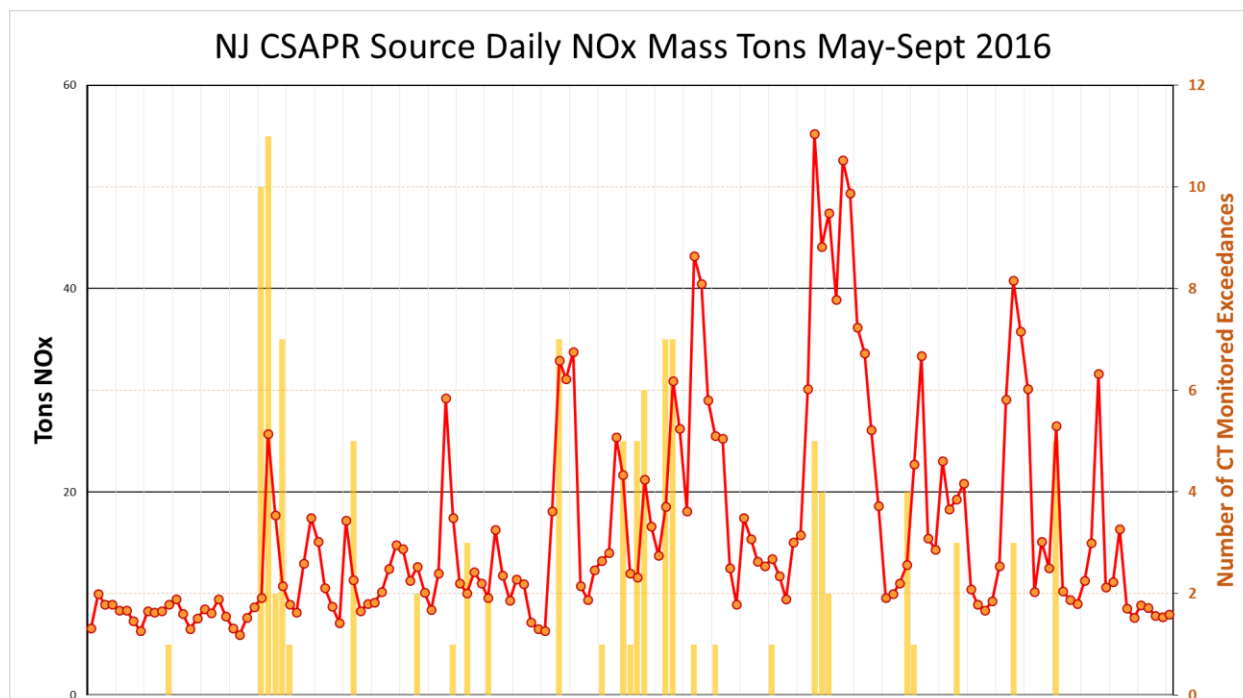


Figure 55. Pennsylvania CSAPR Source 2016 Daily NO_x Emissions

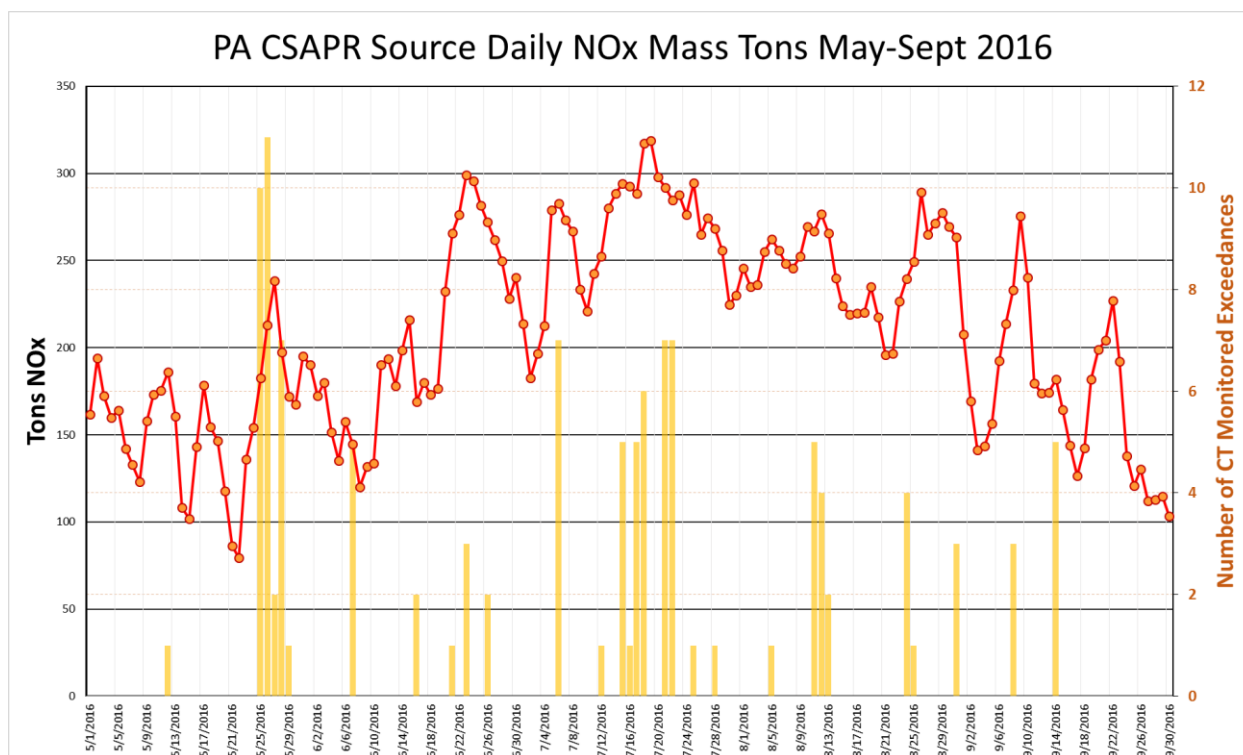


Figure 56. New Jersey CSAPR Source 2016 Daily NO_x Emissions

3.6 NOAA CMAQ Model Predictions

CTDEEP air quality forecasters have relied upon the operational NOAA CMAQ ozone model for daily air quality forecasting. The NOAA CMAQ model v.4.6 ('the model') has used wildfire and dust emissions and suppression of soil emissions from snow/ice covered terrain since summer 2014, however, gaseous wildfire emissions have not been input into the ozone forecast. Although this model has issues about land/water interfaces and using the most up-to-date emissions inventory, it is generally a reliable tool for the air quality forecaster.

From the previous similar day analysis, August 29th 2016 was determined to have a similar weather pattern as May 25th of that year. Figure 57 shows the model output for that day as compared with the AQI levels observed. It is widely recognized that the model over-estimates ozone concentrations in the northeast U.S. during July and August, so this model output is more typical and shows the similarity with the May 25th forecast. In the May 25th case, however, the model is greatly under-predicting the observed ozone levels.

Maryland Department of the Environment air quality staff analyzed gridded model output for May 2016 over the eastern U.S. domain and have plotted the model bias from the observed daily

maximum 8-hour ozone average as interpolated isopleths. Since the model does not assimilate the gaseous smoke emissions into the ozone calculations, the model shows a strong negative bias over the region of the smoke plume. Figure 58 shows the model bias for May 25th, 2016, with areas many areas in the northeast U.S. exceeding a negative 25 ppb model bias. This was plotted without using the observation from the New Haven CT monitor, since it suffers from the NO_x titration phenomenon where ambient ozone levels are almost always much lower than surrounding areas due to its proximity to I-95 and the Port of New Haven.

Hourly plots of observed ozone vs. modeled ozone are also presented for the May 25-26th, 2016 period for three of the monitors that are being requested the data exclusion (Figures 59-61). In every case, it shows that strong negative model bias during the day time hours, under-predicting peak ozone concentrations by as much as 30 ppb.

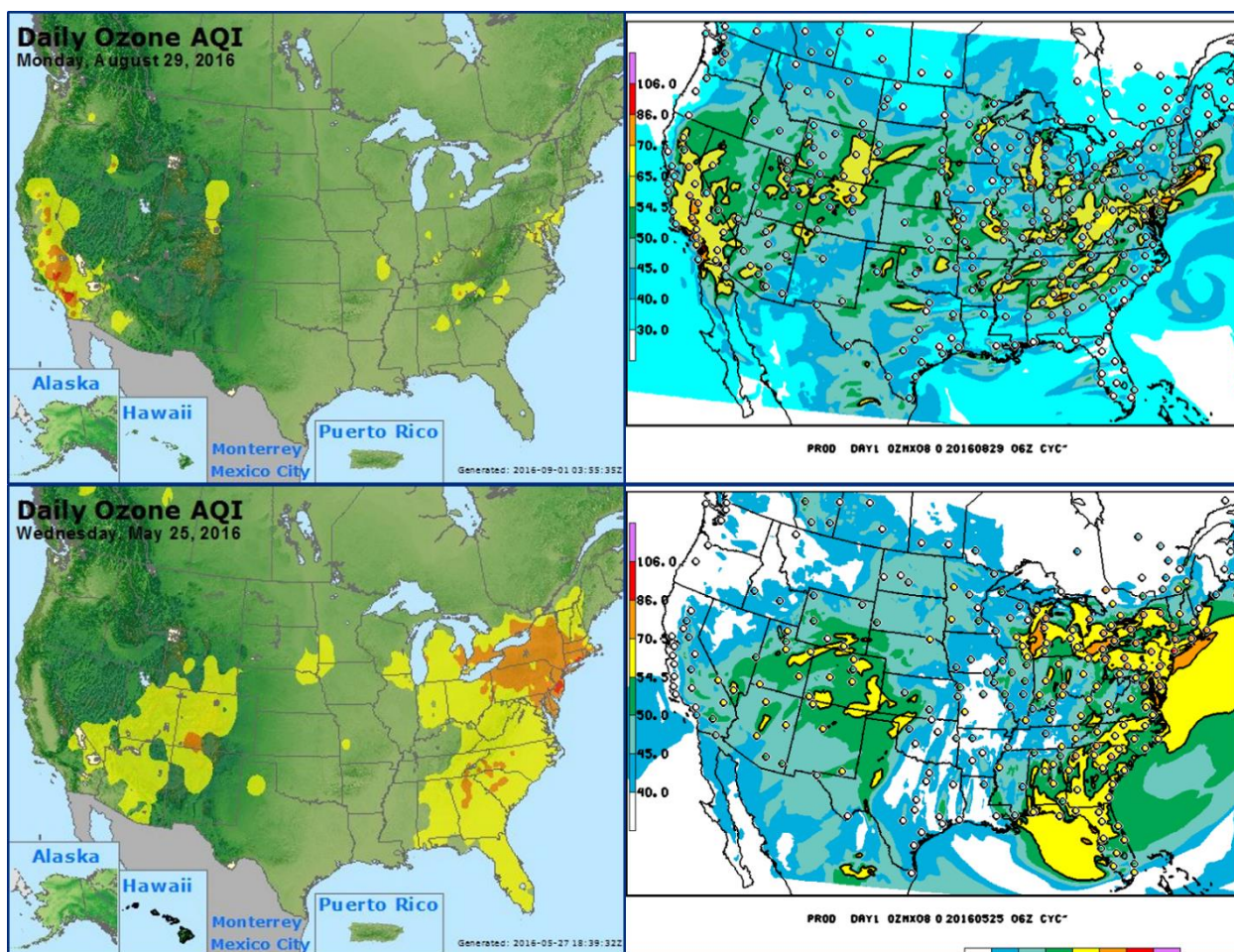


Figure 57. Comparing Similar Day Model Output from August 29th to May 25, 2016 with Observed AQI

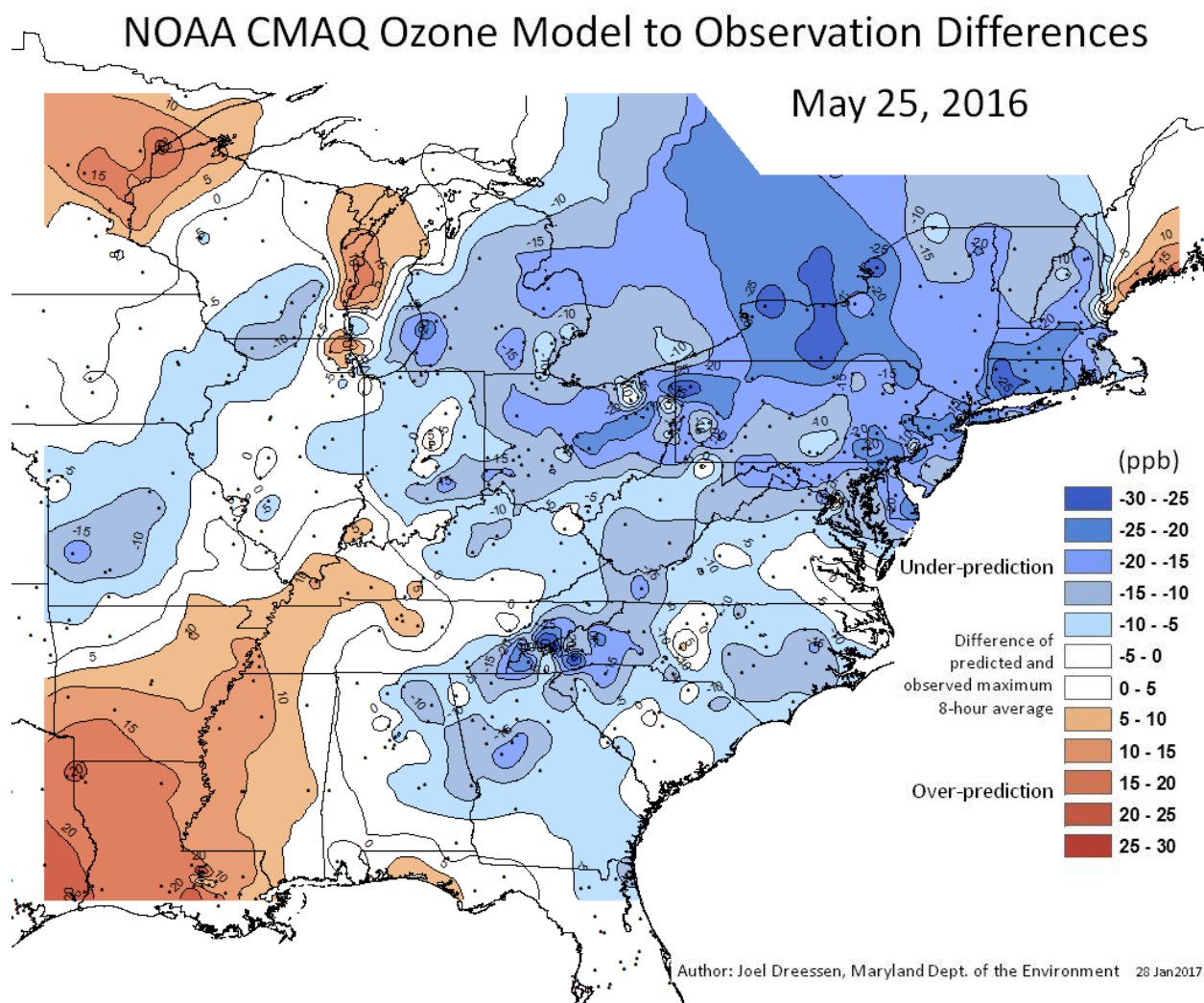


Figure 58. NOAA CMAQ Model Bias Isopleths for May 25, 2016

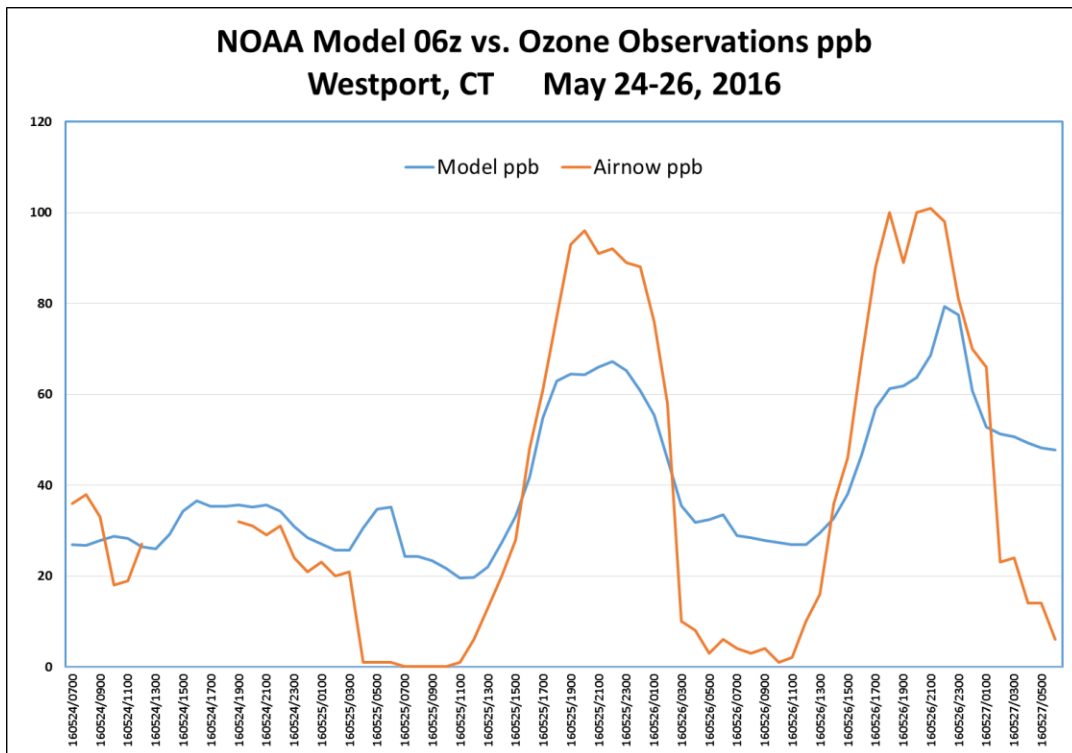


Figure 59. NOAA Model Ozone Forecast vs. Observed for Westport CT

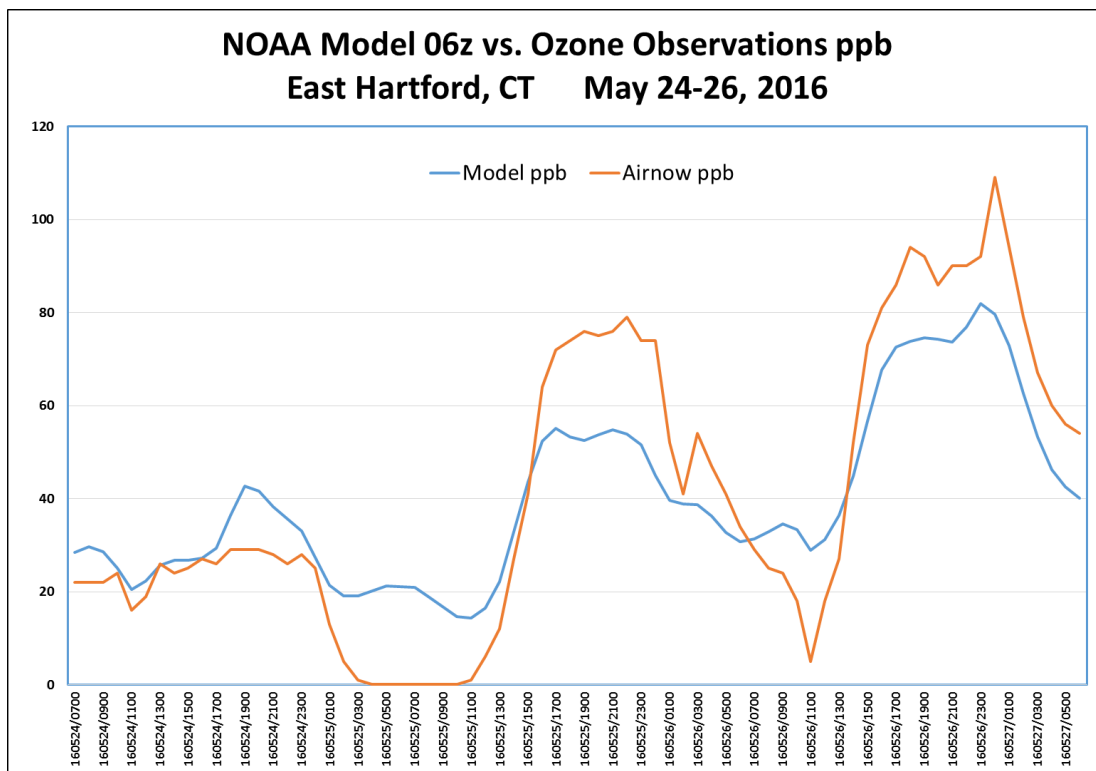


Figure 60. NOAA Model Ozone Forecast vs. Observed for East Hartford CT

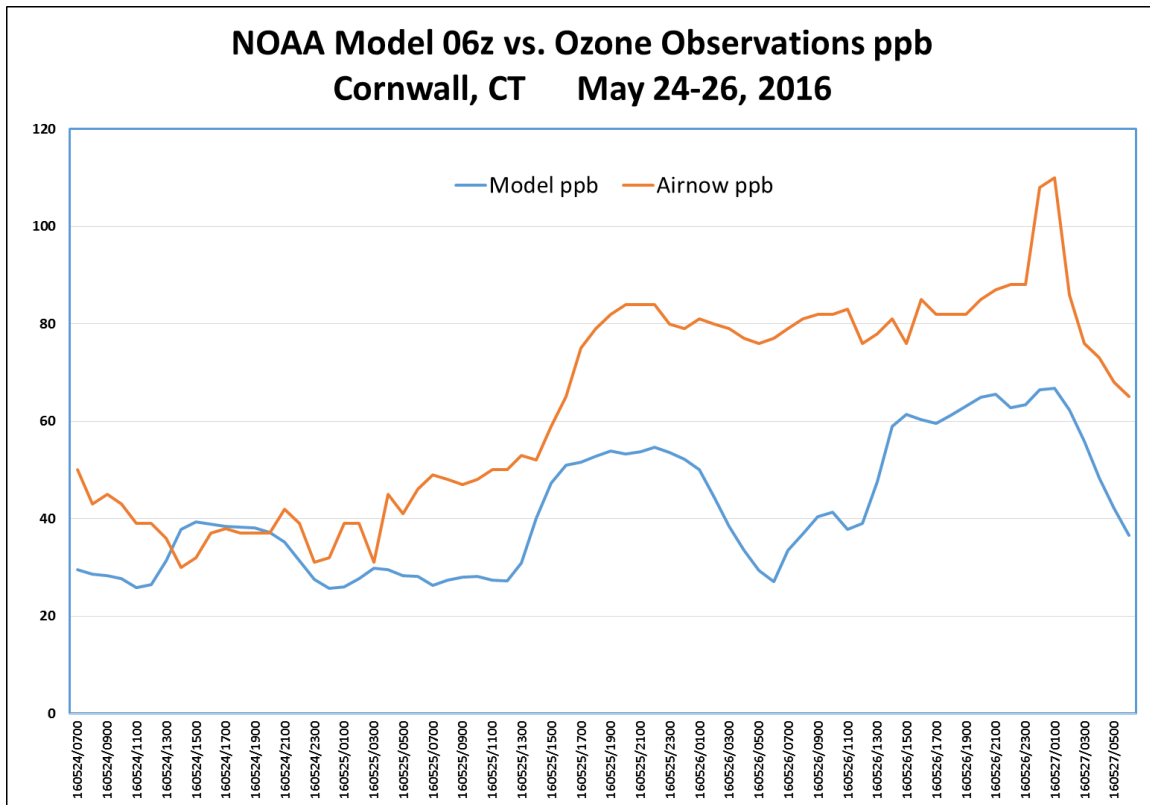


Figure 61. NOAA Model Ozone Forecast vs. Observed for Cornwall CT

3.5 Causal Evidence Conclusion

During May of 2016, an historic wildfire occurred near Fort McMurray, Alberta Canada that generated a massive and lingering smoke plume into July 2016. The VOCs and NO_x that were emitted from this fire were transported over the Great Lakes after May 20th, becoming trapped by a high pressure system, where these precursors contributed to elevated ozone concentrations at numerous monitors in the Upper Midwest States. This elevated ozone and plume was then transported southeast to Connecticut on May 25-26, where numerous ozone exceedances were observed. The monitored ozone concentrations of ozone were compared to historical concentrations during the April-September season since 2012. One or more of these days at each of these four monitors were in the 99th percentile rank over this seasonal basis. Meteorological conditions were not consistent with historically high concentrations, as the similar day analysis has shown of this demonstration supports CTDEEP's position that the wildfire event affected air quality in such a way that there exists a clear causal relationship between the specific event and the monitored exceedance or violation on May 25-26, 2016 of data requested for exclusion, or reference to summary table in demonstration and thus satisfies the clear causal relationship criterion.

4. CAUSED BY A NATURAL EVENT

4.1 Definition of a Wildfire

The Exceptional Events Rule at 40 CFR 50.1(n) defines a wildfire as “...any fire started by an unplanned ignition caused by lightning; volcanoes; other acts of nature; unauthorized activity; or accidental, human-caused actions, or a prescribed fire that has developed into a wildfire. A wildfire that predominantly occurs on wildland is a natural event.”

4.2 Conclusion

Based on the documentation provided in Section 3 of this submittal, the event qualifies as a wildfire, because, while it was not caused by lightning, it was nevertheless an unplanned wildfire event. The EPA generally considers the emissions of O₃ precursors from wildfires on wildland to meet the regulatory definition of a natural event at 40 CFR 50.1(k), defined as one ‘in which human activity plays little or no direct causal role.’ This wildfire event occurred on wildland in Alberta Canada as documented in the introduction, and accordingly, CTDEEP has shown that the event is a natural event and may be considered for treatment as an exceptional event.

5. NOT REASONABLY CONTROLLABLE OR PREVENTABLE

5.1 Exceptional Event Provisions

According to the CAA and the Exceptional Events Rule, an exceptional event must be “not reasonably controllable or preventable.” The preamble to the Exceptional Events Rule clarifies that the EPA interprets this requirement to contain two factors: the event must be both not reasonably controllable and not reasonably preventable at the time the event occurred. This requirement applies to both natural events and events caused by human activities, however it is presumptively assumed that wildfires on wildland will satisfy both factors of the “not reasonably controllable or preventable” element unless evidence in the record clearly demonstrates otherwise.

5.2 Conclusion

Based on the documentation provided in the introduction of this submittal, human activity likely caused the wildfire event on wildland near Fort McMurray, Alberta. CTDEEP is not aware of

any evidence clearly demonstrating that prevention or control efforts beyond those actually made would have been reasonable. Therefore, emissions from this wildfire were not reasonably controllable or preventable.

6. PUBLIC COMMENT (TO BE COMPLETED LATER)

6.1 Exceptional Events Rule Provisions

According to the provisions in 40 CFR 50.14(c)(1)(i), air agencies must “notify the public promptly whenever an event occurs or is reasonably anticipated to occur which may result in the exceedance of an applicable air quality standard.” In addition, according to 40 CFR 50.14(c)(3)(v), air agencies must “document [in their exceptional events demonstration] that the [air agency] followed the public comment process and that the comment period was open for a minimum of 30 days....” Further, air agencies must submit any received public comments to the EPA and address in their submission those comments disputing or contradicting the factual evidence in the demonstration. Air agencies with recurring events may also be subject to the mitigation requirements at 40 CFR 51.930. Air agencies subject to these requirements have additional obligations regarding public notification and engagement.

6.2 Supporting Documentation

Air agencies should include in their exceptional events demonstration the details of the public comment process including newspaper listings, Web site postings, and/or places (library, agency office) where the hardcopy was available. As noted in Section 6.1, the agency should also include comments received and the agency’s responses to those comments.

6.3 Conclusion Statement

The CTDEEP posted notice of this exceptional events demonstration on [date posted] in the following counties/locations: [list counties affected and locations posted]. [Number] public comments were received and have been included in Section 6 of the demonstration, along with CTDEEP’s responses to these comments.